September 5, 1945

# NATIONAL PETROLEUM NEWS

TECHNOLOGY DEPT.

SEP 10 1945

DETROIT

## Oil Engineers Run Fuels, Lubes Branch for Army Ordnance Dept.

Maj. Walter H. White entered active duty on March 27, 1942 from the engineering division—sales department, Standard Oil Co. of New Jersey. He was first in charge of lubrication and preservation problems in connection with small arms and artillery and later was chief of the Technical Section, handling the technical aspects of the fuels, lubricants and cleaning and preserving materials handled by the Fuels and Lubricants Branch. Since March 1944, he has been assistant chief of the Branch, part of that time acting also as chief of Technical Section

Major White was employed by the Standard Oil Development Co. in 1930, after graduating from the Sibley School of Engineering, Cornell University with the degree of Mechanical Engineer. After several years of research and development work on automotive equipment in the laboratories of the Standard Oil Development Co., he joined the engineering division—sales department, Standard Oil Co. of New Jersey

Lt. Col. W. C. Landis has been chief of the Fuels & Lubricants Branch since March 1944. He reported to active duty on March 16, 1942. Prior to becoming chief of Fuels & Lubricants Branch, he served as chief of the Automotive Unit, chief of the Surveillance Unit

Col. Landis is a member of the War Department Committee on Liquid Fuels & Lubricants, Ordnance representative on the special Research Committee on Lubrication of the American Society of Mechanical Engineers and alternate Ordnance representative of the Lubricants Division Society of Automotive Engineers, Standards Committee

Col. Landis graduated from the Virginia Military Institute in 1933, receiving a degree of Bachelor of Science in Electrical Engineering. He served a year as varsity wrestling coach at Virginia Military Institute and then entered extended active duty as an Infantry Officer of the U. S. Army where he remained for four years, reaching the grade of 1st Lieutenant. Upon leaving the Army, Col. Landis chose the petroleum industry for his future and went to work for Shell Oil Co., Inc. He received training in many departments of his company and, prior to reporting for active duty in the Army, he was an industrial engineer in New York

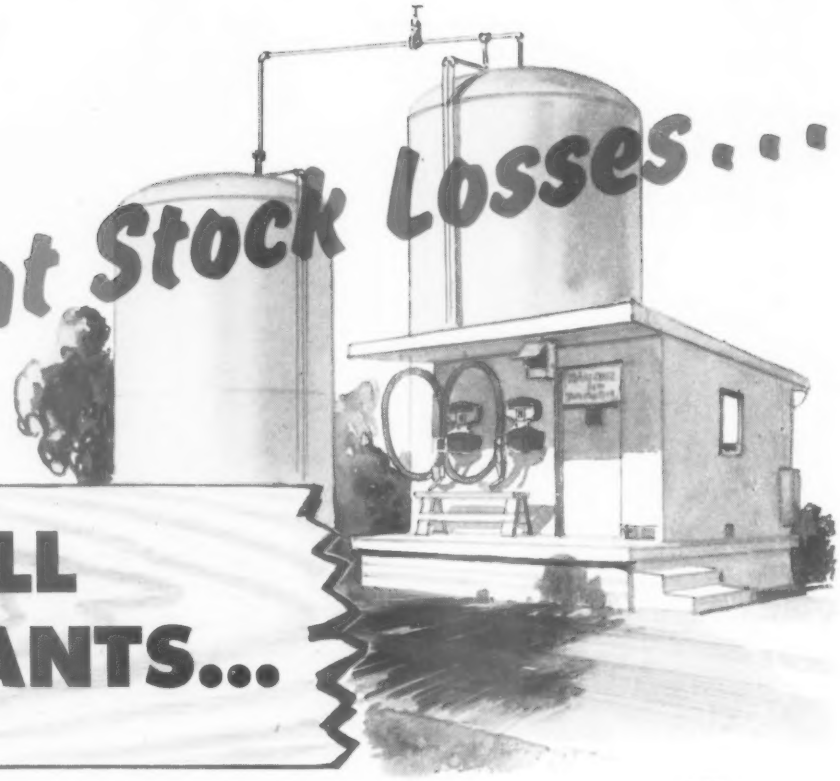
Story and Additional Pictures on Fuels and Lubricants Branch of Army Ordnance Department Start on Page 14

***Other Features in This Week's NPN:***

**Credit Card Back Soon**—Suggestions on how abuses of credit card system may be eliminated. ***Page 23***

**State Legislative Roundup**—Few bills unfavorable to oil industry and its customers get through legislatures in 1945. ***Page 40***

# To Prevent Stock Losses . . .



## SMALL BULK PLANTS...

**Need Meters** rather than locks

**Need Daily Records** rather than keys

Regardless of whether a bulk plant is large or small and whether it has an attendant on duty or not—errors and stock losses will repeatedly occur unless they are checked and corrected as they take place—or at the end of each day, instead of weekly or monthly. To eliminate costly inventory problems and stock losses requires more than just a lock—as locks merely prevent unauthorized withdrawal. By installing Brodie Meters and a simplified form-record of gallonage withdrawals, you secure, not only an accurate system of stock control, but the benefit of an impartial auditor, plus a permanent attendant in your plant twenty-four hours a day, month-in and month-out.

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# A few words will go far in steel drums

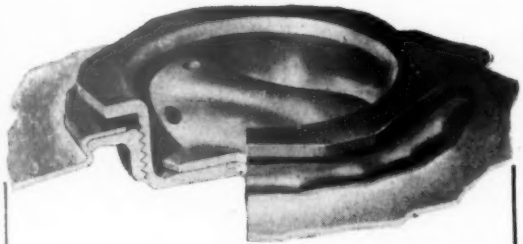
*Top assurances that steel drums will give longer, more efficient and thoroughly leakproof service can be obtained by the inclusion of a few words — the right words — in drum orders.*

## "Drums to be equipped with ViseGrip Closures"

The drums that are built to that specification have the high quality that is basic to the business of all American drum manufacturers . . . *also,* they have strength at the sealing point that surpasses the needs for even the roughest handling in the operations of war.

VISEGRIP Closures are locked into the very drum metal—permanently. VISEGRIP Plugs are made of steel, not a soft, almost-pliable metal. They can be *re*used countless times and they can be relied upon to seal their drums *every* time. The standard plug gasket in VISEGRIP Closures is the VISEGRIP Hycar Gasket. A modern synthetic, this gasket will resist the effects of petroleum products, aromatics, extreme temperatures and almost every chemical.

We feel, sincerely, that it is in the best interest of product protection to have the full story of the construction, insertion and operation of VISEGRIP Closures before every buyer of steel drums. If you do not have it—we shall place it before you, promptly, at your request.



The VISEGRIP Closure is the *all-steel* closure. It seals the drum by locking the drum metal tightly *in a vise.* . . . The drum becomes part of the VISEGRIP Closure and has a single, superior seal.

**Drums with VISEGRIP Closures are sealed and safe . . .**

*With the facts—users of steel drums can specify, confidently:*

**"Drums to be equipped with ViseGrip Closures."**

**Every drum manufacturer in the United States has a stock of VISEGRIP Closures and is equipped to build them into your drums with Rieke dies.**

**VISEGRIP CLOSURES**

***developed and produced for more than 20 years by***

**RIEKE METAL PRODUCTS CORPORATION**

**AUBURN, INDIANA** **NEW YORK, N. Y.**

# Two Stars Of The Texas Company Rise

*Richard L. Saunders*

*Walter Hochuli*

TWO popular members of the Texaco organization moved closer to the top when W. S. S. Rodgers, chairman of the board of The Texas Co., on Aug. 20 announced that Richard L. Saunders, vice president and secretary, and Walter Hochuli, sales manager of the central territory, had been promoted.

★ ★

Mr. Saunders is now head of the domestic sales organization, and Walter Hochuli is general sales manager. Both of these executives started at the bottom. Both have advanced steadily because they had what it takes.

★ ★

"Dick" Saunders, though an old-timer with The Texas Co., is neither old in years nor modern business management ideas. It happened that he had to start working a bit earlier than the average. His first and only employer has been The Texas Co., which he joined in 1909 in New York as a voucher clerk in the sales department. He stayed on this job about a year and rose to bookkeeper, and in a short time became chief of the accounting division of the Northern territory sales department, where he remained for nearly 10 years.

☆ ★

He was promoted to various executive positions, and by 1932 had risen to the position of assistant to general sales manager H. W. Dodge, and continued there until April, 1934, when he was made manager of the company's Northern territory. In 1935, he became assistant general sales manager and in 1938 was appointed secretary of the company. In 1944 he was elected a vice president in addition to his regular duties as secretary. Upon his appointment as head of the domestic sales organization, he resigned as secretary of the company.

Mr. Saunders' hobbies are golf and motion pictures. He has done some amateur cinema work that is professional in quality, and is an ardent camera fan.

★ ★

You could call Walter Hochuli, Texaco's new general sales manager, almost any kind of name without getting much of a rise. But so much as breathe that he is not a Salesman, with a capital S, and there will be serious trouble. They are fighting words to this Marine of World War I, who joined The Texas Co. in 1924 as a salesman, and who has practiced that profession with marked success since that time, with successive rises through every notch of company's sales organization.

★ ★

His ability to manage, as well as actually sell, was demonstrated with his success as manager of Indian Refining Co., Texaco affiliate during the height of the depression, and as assistant and territorial manager for The Texas Co.'s central territory, and with his record as director of the distribution and marketing division and chairman of the domestic operating committee for PAW since April, 1943, which he left on Sept. 1, to take up his new position.

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## BULLETINS

### TRANSPORT DEPT. TO DISBAND

**WASHINGTON—End of ODT's liquid transport department on Sept. 21 was indicated this week in letters to the industry signed by Department Director Porter L. Howeard and A. V. Bourque, S. F. Niness and R. W. Shields, heads of tank car, tank truck and pipeline divisions.**

**The letter thanked the industry for its "wholehearted cooperation and consideration of our problems . . . and the important part you have played in winning the war."**

* * *

### SUBSIDY CLAIM SYSTEM CHANGED

**WASHINGTON — RFC announced it would consider accepting monthly certificates from a pipeline system, in instances where there is affiliation between applicants for stripper well compensatory adjustments and the pipeline system, provided an outside auditing firm acceptable to RFC certifies the pipeline certificate.**

**No claims supported by pipeline certificates should be filed, however, until approval has been asked and granted by RFC.**

* * *

### CRUDE UP 30 PER CENT SINCE '41

**WASHINGTON — Crude production rose "more than 30%" from 1941 through 1944, WPB said this week, listing petroleum as one of America's five top raw materials.**

**Employment in oil and coal industries rose from 147,000 in 1939 to 198,000 in 1944, average work week rising from 38.3 to 45.4 hours in the same period, and plant additions increased by 25% or $1,000,000,000, a report on "The effect of world war II on the American industrial economy", said.**

* * *

### TIRE MAKING RULES CHANGED

**WASHINGTON — WPB on Sept. 5 removed all restrictions on the number of passenger automobile tires that may be manufactured. Also removed were restrictions on production of passenger car tubes and small truck tubes.**


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NATIONAL PETROLEUM NEWS
NPN
NEWSMAGAZINE FOR OIL MANAGEMENT MEN

# Revocations, Amendments Ease Load of Regulation, But Many Controls Still On

## Lists of PAW, OPA, ODT, WSA and RFC Orders Eliminated And Those Continuing in Effect Compiled by NPN

NPN News Bureau

WASHINGTON — Sweeping revocations and amendments of restrictions since the Japanese agreed to surrender have altered markedly the extent of government control over the oil industry.

Most PAW controls will have disappeared by the end of the month. On the other hand, practically all OPA regulations affecting prices continue in force.

To bring the record of government control up to date, NPN has compiled the following summary of PAW, OPA, ODT, WSA and RFC regulations concerning the oil industry—those wiped from the books and those remaining. A similar summary for WPB and ICC will be published at a later date.

### Petroleum Administration for War

#### ELIMINATED

**PAOs**—1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 23 (and 16 supplementary orders to PAO 11).

**PDOs**—13, 14, 18, 19, 20, 21, 22.

**Directives**—52, 57, 61, 64, 65, 66, 67, 68, 71, 72, 74, 75, 77 (except that Army Petroleum Products Allocation Committee will continue to allocate and PAW to distribute supplies of finished avgas of higher than 130-octane rating; same procedure to continue to apply to off-shore shipments of alkylate and other high octane blending agents), 79, 80, 81.

Telegraphic directive of July 13, 1944, signed by Bruce K. Brown, concerning octane ceiling on housebrand and premium gasoline.

Telegraphic directive of July 12 or 13, 1945, signed by A. P. Frame, setting specific volumes of lubricating oils to be manufactured by 21 companies during last six months of 1945.

**Recommendations**—1, 2, 3, 4, 5, 6, 8, 9, 10, 13, 14, 16, 25, 28, 29, 30, 31 amended, 32, 35, 36, 37, 38, 39, 40, 43, 44, 45, 46, 47, 56, 58, 61.

**PAW information forms**—5, 7, 13, 17, 33, 39, 41, 48, 53, S-15.

All administrative letters, field orders and other directions governing well-spacing patterns, drilling limitations and designation of restricted areas.

Practice of certifying monthly petroleum liquid production rates, for all states except California. (PAW now only recommends to states the rates at which it thinks they ought to produce.)

#### STILL IN EFFECT

**PAW Administrative and Distribution Orders**

OPC Administrative Order—Tanker Coordinating Board appointed.

No. 12—Materials for petroleum marketing.

**PAW Recommendations, Directives**

NOTE: No Recommendations numbered 15, 17, 18, 20, 21, 22, 26, 27, 34, 53, 54, and 60 have been released.

No. 7—District Industry Committees.
No. 11—Tanker subcommittee for Pacific Coast (to be eliminated Sept. 25).
No. 12—Distribution of transportation costs (to be eliminated Sept. 25).
No. 19—Production in California.
No. 23—Alkylation royalties reduction (to be eliminated Sept. 15).
No. 24—Petroleum Industries War Council.
No. 33—Distribution of oil supplies.
No. 41—Licensing agreements (to be eliminated Sept. 15).
No. 42—American refining processes for Russia.
No. 48—Exchange of technical information (to be eliminated Sept. 15)
No. 49—Pipe line expansion program (to be eliminated Sept. 25).
No. 50—Transportation, refining adjustment (to be eliminated Sept. 25).
No. 51—Barge equipment (to be eliminated Sept. 25).
No. 55—Paratone deliveries restricted (to be eliminated Sept. 15).

## Jobbers Pick Committees For Accounting Study

NPN News Bureau

CHICAGO—Eighteen council members attending a two-day meeting of the National Council of Independent Petroleum Associations at the Bismark Hotel, here Aug. 28-29 appointed two committees to further the council's plans for separate accounting for the marketing branch of the industry.

Moving a step nearer its goal, the council appointed a policy committee to study material to be presented to the O'Mahoney Senate Investigating Committee. The policy committee is made up of E. V. Weber of Ohio, chairman; R. J. Rogers of Indiana, and J. E. Adrian of South Dakota.

A co-ordinating committee also was appointed, with H. L. Thatcher, chairman of the national council, as chairman. The committee will give final approval to the statement to be presented to the Senate committee and also send this statement to the various state organizations for final approval. Others on the committee are: E. V. Weber; C. M. Barringer of North Carolina; J. E. Adrian, and George Haering of Arkansas.

No. 59—Pooling of supplies, transportation and terminal facilities in District One; Minimum specifications for petroleum products pursuant to Dir. 59.
No. 62—Credit cards banned (to be eliminated Sept. 15).
No. 63—Operating of War Emergency Pipeline.
No. 69—Allocation and use of inland waterways equipment (to be eliminated Sept. 25).
No. 70—Coordination of foreign operations.
No. 73—Pipe line operations.
No. 76—Joint use of facilities plan (to be eliminated Sept. 15).
No. 78—Supply program in District Three (to be eliminated Sept. 25).

### Office of Price Administration

#### ELIMINATED

Ration Orders 5C, 9A, 11, parts of ROA concerning truck tires (see below under Still in Effect—Ration Orders.)

#### STILL IN EFFECT

**Forms**

OPA 652-2170 — stripper wells

**General Maximum Price Regulation and Supplementary Regulations**

GMPR—Prices for commodities not otherwise covered
SR 1—Commodities exempt from GMPR
SR 11—Services exempt from GMPR
SR 14—Modification of prices covered by GMPR
SR 14-F—Chemicals, drugs and paints
SR 14-H—Transportation services
SR 14-J—Consumer goods
SR 14-K—Machinery and parts (second hand electric motors, reconditioned and used valves)
SR 15—Adjustment of prices covered by GMPR

**OPA Maximum Price Regulations and Price Schedules**

Maximum Export Price Regulation (Second Revised)
MPR 28—Ethyl alcohol (except West Coast)
MPR 42—Paraffin wax
RMPR 43—Used steel drums, effective September 4.
MPR 49—Resale of iron or steel products
MPR 53—Fats and oils
MPR 87—Scrap rubber
MPR 88—Bulk fuel oil, gasoline,

liquefied petroleum gas. Amendment 30, providing 15 per cent reduction in residual ceiling in Georgia and part of Florida, effective Aug. 1. Amendment 31, establishing tank wagon prices for Pacific standard 100 and 200 in certain tank wagon areas in California, and establishing maximum tank car and tank wagon prices for aviation gasoline below 87 octane, delivered at destination in middle west. Amendment 32, eliminating the revenue price increase in 17 eastern states and the District of Columbia, restoring the base period 72-74 octane bracket, ceiling for which is ⅛ cent higher than that in effect for superseded 70-74 bracket, and restoring for 60 days the 3/10 cent increase granted fuel oil dealers.

MPR 96—Domestic fuel oil storage tanks

RMPR 131—Camelback. Amendment 3, establishing differential between large and small wholesalers, effective Aug. 13.

MPR 134—Rental of construction, road maintenance equipment and services

RMPR 136—Batteries (machines and parts). Amendment 6, amending the definition of a "rebuilt and guaranteed" product to specify one that meets conditions outlined in order at time of delivery to purchaser or lessor, effective Aug. 4. Amendment 9, eliminating the requirement for separate billing of product and service in the same structure, effective Aug. 30.

RMPR 137—Service station prices. Order 5, authorizing prices for aviation gasoline in California, Washington and Oregon, effective Aug. 28. Amendment 11, eliminating special pricing method for motor fuel, effective Sept. 4. Amendment 12, restoring for 60 days the 3/10 cent per gallon increase granted on fuel oil at the retail level.

RMPR 165—Consumer services. Amendment 3 to Supplementary Service Regulation 49, effective October 10, and Amendment 4 to Supplementary Service Regulation 49, effective September 1, deal with automotive repair services.

MPR 170—Anti-Freeze.

MPR 230—Reusable pipe.

MPR 323—Asphalt.

MPR 341—Used commercial vehicles.

MPR 411—Reusable steel storage tanks.

RMPR 436—Crude oil, and petroleum and natural gas. Amendment 17, providing Lance Creek field may preserve its base period contract prices which were above the base date posted (ceiling) price, effective Aug. 8. Order 37 under RMPR 436 establishes stripper well subsidies.

MPR 453—Automotive parts, wholesale and retail.

MPR 465—Used pressure vessels.

MPR 510—Bulk lube oils, greases, naphthas, solvents.

RMPR 528—Retail tires and tubes (new); used and recapped tires and tubes. Order 53, providing used airplane tire ceilings, effective Aug. 2; Order 54, providing new solid tire retail ceiling, effective Aug. 7. Revised Order 36, providing Goodrich R-5 industrial tractor tire ceilings, effective Aug. 14. Order 55, providing ceilings on new sizes Goodyear farm tractor rear tires and mud and snow truck tires, effective Aug. 14. Amendment 3, providing ceilings on tube repairs, used tires, basic carcasses, retreading, repairing and repair materials, effective Aug. 22.

MPR 566—Tank truck contract carrier rates.

MPR 581—Industrial services. Amendment 2, which clarifies scope of order, effective Aug. 4.

MPR 586—Storage and terminal services.

### Ration Orders

RO 1A—Mileage rationing: tires. Amendment 103, dealing with validity of tire certificates, effective Aug. 3. Amendment 104, setting no time limit on transfers against form R-2 certificates accepted before expiration date, effective Aug. 10. Amendments 105-106 taking used truck tires off the ration list, effective Aug. 15. Amendment 107, describing eligibility for tires for autos, trailers, all commercial vehicles, based upon use, effective Aug. 17. Amendment 108, releasing new industrial and tractor implement tires from rationing effective Aug. 21. Amendment 109, allowing dealers substantial increases in inventories of rationed passenger and truck tires, effective Sept. 1.

## Office of Defense Transportation

### ELIMINATED

General Orders 7, 37, 19, 20 A and 218 supplementary orders to 20A; and ODT 19, the latter effective Nov. 1. Also supplementary orders 1 through 148 of 6A.

### STILL IN EFFECT

ODT Administrative Order 1—Delegation of authority.

ODT 6b, regions and districts of motor transport and local transport divisions.

ODT 10, procedure for registration of empty trucks.

ODT 14, applications for relief from compliance.

ODT 15, extension, inauguration, of motor carrier service.

ODT 17A, procedure under General Order 16B, freight shipments to or within U. S. port or storage areas and to or through Canada.

General Orders 3, common carriers; 4, contract service; 5, private carriers; 6A, local delivery services, except for 148 supplementary orders revoked; 13, joint information offices; 18 and 18A—carload shipments and loading requirements for carload freight; 21, 21A—certificate of war necessity and certificate of war necessity for commercial vehicle.

Special Order R-6, pooling hopper cars for carbon black.

## War Shipping Administration

### ELIMINATED

No regulations applying to tankers:

### STILL IN EFFECT

Rate Orders Nos. 267, 275, 277, 278, 302, 309 and 323. Also retained Rate Orders Nos. 334 through 346 inclusive, 348 and 349, but cancelled a 10% surcharge applicable to basic voyage charter rates for transportation of bulk liquid cargoes in tankers under those orders. WSA Rate Order No. 378, issued Aug. 27, said: "All surcharges stipulated in currently effective rate orders and rate advices and heretofore applicable to basic voyage charter rates for the transportation of bulk liquid cargoes in tankers in various trades are hereby cancelled, effective on loadings completed on and after Sept. 1, 1945.

"Specifically, the surcharges cancelled by the terms of this order are as stipulated in the following listed rate orders and rate advices: Rate Orders Nos. 334 through 347 inclusive, 348 and 349. Rate Advices Nos. 123 through 128 inclusive, 131, and 132."

Also retained are the following general orders applicable to tankers:

GO 2, Supplement 1—Uniform charter party.

GO 8, Supp. 10, Time charter rates for tankers (this is superseded by GO 37—Values and rates for charter hire—only in cases where revised charters were executed).

GO 11, Supp. 4—Revised time charters for tank vessels; Supp. 6—Special time charter for requisitioned tank vessels; Supp. 11—Uniform time charter for certain tankers; Supp. 9—Time charters, disputes addendum.

REV. GO 12—Compensation of general agents and agents.

GO 13, Supp. 1—Requisition bareboat charter for tank vessels; Supp. 2—Special requisition bareboat charter, dry cargo and tank vessels.

REV. GO 27—Sale and charter of barges (will be revoked shortly, probably before Sept. 10).

GO 30—Price adjustment board.

GO 34—Tanker, tug and barge rates.

GO 37, supplements 1 through 6—Contracts with vessel owners and rates of compensation relating thereto.

GO 11, Supp. 4, amendments 1 and 2—Foreign flag tankers.

## Reconstruction Finance Corporation

### ELIMINATED

None.

### STILL IN EFFECT

Revised regulation 1—Petroleum Compensatory adjustments. Amendment 8, changing references from DSC to RFC

effective July 1. Amendment 9, amendment 2 to revised schedule "B", amendment 3 to schedule "C" and revised table 3, and amendment 6 to schedule "E", carrying out provisions of Aug. 18 notice to applicants, effective Sept. 1. (See page 8)

Regulation 5 — Compensation for crude shipments from district 3 to district 2. Amendment 4, changing references from DSC to RFC, effective July 1. Amendment 3 to Revised Schedule "A", announcing additions to compensable list, effective July 1. Amendment 4 to Revised Schedule "B", announcing additions to compensable list, effective July 1.

Regulation 7—Stripper well compensatory adjustments. Amendment 4 to Revised Schedule "A", announcing changes in stripper well subsidy list, effective July 1. (See Below)

## Stripper Well Subsidies Changed By R. F. C.

NPN News Bureau

WASHINGTON—To bring its subsidy list into line with OPA's, RFC has added 17 pools or areas to those entitled to stripper well premium payments, deleted two others and made revisions in the compensation allowable for six others.

Action was taken by issuing Amendment 5 to Schedule "A" of RFC's Stripper Well Compensatory Adjustments Regulation 7, and came as result of amendment to order 37 of OPA's RMPR 436, which was designated as Schedule "A" of the RFC regulation.

Pools or areas added to the list, and the amount of increase per bbl:

Arkansas—Nick Springs (Travis Peak), 24c; Illinois—Maunie South, 20c; Kansas—Russell North, 35c; Michigan—Temple, 2c; Oklahoma—Allen (10-2000 ft), 35c; MaComb South, 35c; Palacine, 20c; Wellston North, 35c; Texas—Hull-Silk-Sikes-Caddo, 25c; Iatan North, 15c; Loving, 25c; Olson, 17c; Smyer, 20c; Wyoming—Half Moon, 35c; Maverick Springs, 28c; Pitchfork, 34c; Shoshone, 35c.

Revised prices include:

Kansas—Graber, 25c; Wherry, 25c; New Mexico—Benson, 9c; Oklahoma—Dora, 35c; Loco, 25c; Texas—Vincent (4000-5000 ft.), 25c.

Eliminations include:

New Mexico—Allen (shallow); Texas—Vincent.

## 48-Hour Work Week Order For Essential Plants Revoked

NPN News Bureau

CLEVELAND—Executive Order 9607, issued Aug. 30, 1945, revokes Executive Order 9301, issued Feb. 9, 1943, making the 48 hour minimum work week obligatory "for the duration of the war" in all establishments which wished to qualify themselves as "making the most effective utilization of manpower"—a condition imposed by the War Manpower Commission upon employers seeking to be declared "essential" to the war effort, and thereby to obtain priorities on hiring workers.

The Chairman of the WMC was granted power, in EO 9301, to determine all questions of interpretation under this order. The reclassification of labor market areas issued monthly by WMC divided the United States into four groups as to labor supply: I (areas of acute shortage), II (moderate shortage, approaching balanced demand-supply situation), III (balanced supply and demand), IV (surplus labor). In areas listed under Groups I and II the 48-hour week was mandatory. All WMC controls were removed on August 15th, and the 48-hour week has since then been without administrative machinery to erforce it.

Executive Order 9240, requiring time-and-one-half for all hours of work numbering over 40, and prohibiting premium wages (double time) for Saturday or Sunday work, except when performed on the sixth or seventh day of the regular work week, is still in force.

The Fair Labor Standards Act, administered by the Wage & Hour Administrator, initiated the 40-hour maximum week in 1938, with overtime pay for all hours above that number, as to all employers whose activities enter into interstate commerce.

## Socony Increases Pay of 21,000 As Work Week Is Reduced

NPN News Bureau

NEW YORK — Socony-Vacuum Oil Co. over the week-end announced a salary increase of 10% for approximately 21,000 employes in the non-executive classification. It applies to all production, refinery and distribution employes, aside from executives. Out of about 23,000 total employes, 21,000 will get the raise.

The increase became effective Sept. 1, and the company announced that as soon as possible each operation on an extended work week would revert to the normal work week. Employes who have been on leave with the armed services and who return to the company's active payroll will receive the pay increase.

## Jersey Standard Proposes Increase In Hourly Rates

NPN News Bureau

NEW YORK — Standard Oil Co. (N. J.) has proposed a 15% increase in hourly pay, which is designed partially to offset a reduction to the 40-hour work-week, it was revealed here by Eugene Holman, president of the company, in announcing that representatives of management and labor in operating affiliates were discussing the new schedule of wage adjustment.

Mr. Holman said the proposal was planned to cushion transition from the overtime work schedules of war to the normal peace schedule and to absorb some of the slack in "take-home" pay resulting from the ending of extended working hours for war production. He said that the move was in accord with the renewed rights of employers and employees to bargain on wage increases so long as the result of the bargain did not increase prices.

Mr. Holman said that the proposed changes would be made according to the following formula:

1. In units where the present work-week is 48 hours, it should be reduced to 44 hours on or about Sept. 1 and basic wage rates would be increased 5 per cent with time and one-half for the four hours above 40.

2. The work-week would be further cut to not over 40 hours not later than January 1, with an additional increase of 10 per cent of the present basic wage rate.

"Full employment and maintenance of purchasing power are of particular importance at this moment," Mr. Holman said. "The cutback in weekly working hours and the 15 per cent wage increase are designed to help meet these objectives.

"To cut back to 40 hours a week without making some adjustment would mean, to large groups of our employees, a reduction of 23.2 per cent in their weekly take-home pay. The upward adjustment will mean that the reduction in take-home pay will be less than 9 per cent and workers will have a long-awaited day a week off."

The increase will apply not only to plant workers but also to all office workers except executives. If all personnel involved accepted the proposal it would affect about 36,000 people.

The parent organization also announced it will begin observance again of minor holidays and of prewar overtime rules, which were discontinued in keeping with the Presidential order during the emergency.

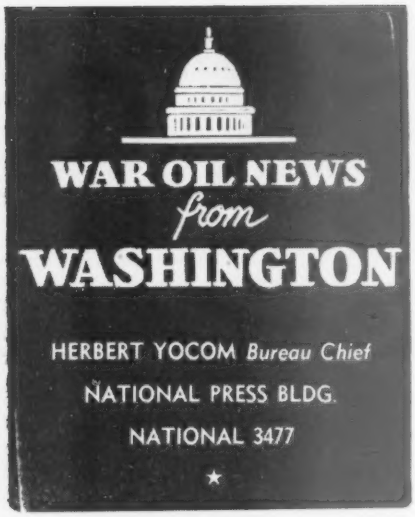
## WLB Approves Increases Up To 55 Cents An Hour

NPN News Bureau

WASHINGTON—Employers may now raise wages to 55 cents an hour without War Labor Board approval, even though the increases "result in a request for a price increase or in increased cost to the government," the Board announces.

Action was taken by amending general order No. 30, effective as of Aug. 30, as follows:

"Increases in wage or salary rates which do not bring such rates above 55 cts. per hour may be made without the approval of the National War Labor Board although the increase will be used in whole or in part as the basis for seeking an increase in price ceilings or for resisting otherwise justifiable reductions in price ceilings, or, in the case of products or services being furnished under contract with a federal procurement agency, will increase the cost to the United States."




## Class 2-B Eliminated By Selective Service

NPN News Bureau

WASHINGTON—National headquarters of Selective Service this week announced elimination of class 2-B, which included registrants deferred because they were "necessary to and regularly engaged in an activity in war production." Local boards are being instructed to transfer from that classification to Class 2-A, those registrants found to be "necessary to and regularly engaged in an activity in support of the National Health, Safety and Interest."

Oil industry workers probably will be included under that heading, draft officials told NPN, but final determination is being left up to the local boards. Local boards have been given no specific list of industries to be given first preference in classifying men in 2-A, but have been given the following definition of "National Health, Safety and Interest":

**Selective Service Definition**

"(1) The production and services required to maintain the armed forces of the United States during the period of the occupation of enemy territory; (2) Research, development and manufacturing of weapons or other items necessary to the maintenance of adequate national defense; (3) Transportation and other activities required for the demobilization of our armed forces; (4) Activities and services required for an expeditious reconversion from a wartime to a peacetime economy; and (5) Other activities which the local board considers essential on a national or local basis."

At the same time, Selective Service said that form 42 or 42A should be used by employers requesting occupational deferment of their employees, although no certification by a government agency (PAW in the case of oil industry) is now required.

## Some Materials for Oil Industry Are Tight, Others Plentiful; Motors a Bottleneck

NPN News Bureau

WASHINGTON—In face of a plentiful supply of some materials for the oil industry, others are likely to be scarce for periods up to a year.

The outlook for the next few weeks is still one involving many questions for manufacturers. However, by Oct. 1, virtually all Federal orders covering priorities assistance, quota limitations and similar restrictions will have been lifted. Today, looking to the future generally, the picture shows:

Mill shapes, including tube and pipe; supply for most part eased, or about to ease to considerable extent.

Internal combustion engines and parts; tight, but rapid improvement indicated.

Valves and instruments; easing in supply, but heavy peace operations demand foreseen.

Construction machinery; tight.

Cordage; sisal and manila critically short.

Containers; tight tin situation likely to continue.

Going into detail, the picture right now is as follows:

**Power Equipment** — steam turbines, mechanical drive, on normal peacetime availability.

**Turbo-generators** — 3,500-kw and above, on 12-to-16-month delivery schedules.

**Boilers** — water tube deliveries generally reverting to normal; oil country boiler manufacturers booked through February, 1946, deliveries on 7-month or longer schedules likely.

**Power distribution transformers** — normal deliveries should be obtainable.

**Watt hour demand meters**—tight for months to come.

**Motors** — electrical, tight; 30-to-40-week deliveries indicated on standard design, explosion-proof motors; vertical hollow-shaft motors on 50-to-60-week promise; recommended that consideration be given steam turbines for emergency requirements for remainder of 1945 and 1946; integral gear motors on 30-to-40-week schedule now but easing indicated; fractional horsepower motors on 70-to-80-week schedule, relief not anticipated for many months.

**Pumps** — about two months behind normal shop cycle; if companies cease to "name purchase", emergency requirements should be available and anticipated requirements near normal peacetime deliveries.

**Fabricated products** — fabricators of heat exchangers, pressure vessels, tanks, fabricated pipe, etc., looking for orders; mill shape: tubes, emergency and reconversion requirements should be met within reasonable time; pipe, seamless and electric weld, in heavy demand, mills scheduling new line-pipe orders for December, lap-weld available in September, butt-weld being scheduled for November and December; plates: steel plate should be obtainable within 30 days or less, structural steel in standard sizes may be available in September, general run of structural pieces in October and November; steel sheets: supply will continue tight because of reconversion demand; castings tight, will ease as manpower situation improves.

**Internal combustion engines** — cooperation of engine manufacturers promised for peacetime requirements, but many engines deteriorated by wartime overload need immediate overhaul or complete replacement, early easing of parts supply anticipated and some easing of large-type drilling engines likely within short time.

**Valves and instruments** — popular types of instruments tight, despite cutbacks, and heavy pentup demand is expected to become apparent soon; consideration of alternate instruments recommended where feasible, control valve situation similar, other valves soon back on peacetime basis; steel-lubricated plug valves anticipated in tight supply for many months.

**Construction machinery** (tracktype tractors, motor graders and draglines)—with WPB controls removed, applicants who still want equipment previously applied for should place "firm order" with dealer; supply situation should improve rapidly.

**Cordage** — Order M-84 expected to remain in effect until January 1, 1946, due to critical shortage of sisal and manila fiber; efforts being made to ease situation in California.

**Containers** — tin critically short; Order M-81, covering metal cans made of tin plate, to be continued indefinitely, likewise restrictions on tin plate for bottle closures.

**Surplus war property** — PAW's redistribution section will be discontinued shortly after abolition of DPC industrial equipment redistribution board as of August 31; for present or future machine-tool requirements applicants are urged to communicate with their local RFC regional offices to determine availability there or through other RFC regional offices; revocation of P-98-C as of September 1 eliminates necessity for operators filing form MA-3A with PAW offices on surplus tubular goods.

## Sets High Mark for Tires But Won't Predict Ration End

NPN News Bureau

WASHINGTON—WPB today forecast all-time record tire production in 1946, but joined OPA in officially declining to predict when rationing would end.

Well-informed sources told NPN, however, that truck tire rationing probably would be removed before Jan. 1, 1946,

although passenger tires may have to be rationed for a longer period.

"Rationing of tires should continue only so long as the difference between supply and demand makes orderly distribution without rationing impossible," WPB and OPA officials said. "Truck tires probably will be removed from rationing before passenger car tires, and new cars will be supplied with only four tires as tires still are needed for rolling wheels now on the road."

Tire production schedules announced for the last quarter of 1945 and for the full year 1946 are:

Fourth quarter, 1945 — 11,774,000 passenger tires and 4,480,000 truck tires.

1946—66,000,000 passenger and motorcycle tires, an all-time peak topping the 1941 record by 13,000,000; 15,380,000 truck and bus tires, and 860,000 tractor tires.

Although production of cotton tire cord and resins are temporarily impeding all-out tire production, carbon black poses no such problem. According to WPB, carbon black needs for 1946 are estimated at 977,000,000 lbs. with present annual production about 1,000,000,000 lbs.

## Hochuli Praised For His Work As PAW Marketing Director

NPN News Bureau

WASHINGTON—High praise from Deputy PAW Davies follows Walter Hochuli on his return to The Texas Co. from the directorship of PAW's distribution and marketing division.

"The government and the general public," said Mr. Davies, "owe Mr. Hochuli a debt of gratitude for the exceptionally skillful manner in which he handled the marketing and distribution of petroleum products, despite severe wartime dislocations. His ability and devotion during his service with the government have been outstanding."

Mr. Hochuli had headed the Distribution and Marketing Division since April 12, 1943, and served on a number of important committees dealing with the wartime oil situation. He was chairman of both the Petroleum Requirements and the Domestic Operating Committees.

Resigning the agency post September 1, Mr. Hochuli lauded the "fine cooperation" he received from industry committees concerned with distribution of gasoline and control of fuel oil.

## Oil Inspection Tour Off

NPN News Bureau

WASHINGTON—The European oil inspection tour planned by the House Interstate and Foreign Commerce Committee's petroleum subcommittee has been cancelled following a poll of members. The group had only about enough funds to meet transportation costs at commercial rates which presidential directive requires the army to charge for travel accommodations.

# Lend-Lease Oil to Allies Was Over Two Billions, Final Truman Report to Congress Shows

NPN News Bureau

WASHINGTON—America transferred $2,184,730,000 worth of oil products to her allies in lend-lease aid from March 1941 to July 1, 1945, 5.2% of the total aid extended under that program, it was disclosed last week in final report on the program submitted to Congress by President Truman.

At the same time, the President reiterated his earlier announcement: "The great task of lend-lease has now ended."

Programs are being speedily terminated, he said, "subject to military needs for the movements of troops or for occupation purposes."

Underlining the importance of oil in the war, the report said:

"Munitions, and petroleum products for fueling allied planes, ships, military vehicles and war production totaled $22,876,000,000 and accounted for more than half of total lend-lease aid ($42,020,779,000) through June 30, 1945."

Petroleum and coal products which the United States received from her allies through "reverse lend-lease" through April 1, 1945, meanwhile totaled $1,209,379,000, the report stated.

The United Kingdom, largest single recipient of oil products from the U. S. under lend-lease, also led the list of countries giving us reverse lend-lease in oil and coal products, $910,365,000 worth.

The only other nations giving U. S. reverse lend-lease in those items were India, with $248,435,000, and New Zealand, with $3,282,000.

The breakdown of lend-lease oil aid to our allies, showing January-March 1945, and April-June, and cumulative totals, compared with total aid given each country, is as follows:

| Nation | Lend-Lease Oil Aid (In 1,000 dollars) Petroleum Products Jan-Mar 1945 | Apr-June 1945 | Cumulative to July 1, 1945 | Total Commodities Cumulative to July 1, 1945 |
|---|---|---|---|---|
| United Kingdom | 172,352 | 186,488 | 1,479,045 | 13,498,748 |
| U. S. S. R. | 13,237 | 19,098 | 103.975 | 9,128,875 |
| China | 11 | 146 | 1,787 | 197,999 |
| India | 38,795 | 32,644 | 149,292 | 2,033,385 |
| Australia | 4,861 | 6,344 | 134,054 | 1,169,260 |
| New Zealand | 546 | 1,598 | 15,601 | 209,438 |
| France | 1 | 15 | 16 | 134,719 |

# Big, Little Inch Rates Cut to Tanker Figures

NPN News Bureau

WASHINGTON—A reduction of rates for the "big inch" and "little big inch" pipelines, effective Sept. 1, reflects the Reconstruction Finance Corporation's desire to provide petroleum for east coast purchasers at rates equal to those charged for tanker transportation, even though sufficient tankers are not yet available to supply all East Coast needs.

RFC explains it does not feel that East Coast refiners and marketers who are forced to depend upon the two emergency pipelines should be penalized, when their competitors are able to get supplies by tanker at much lower rates.

However, RFC emphasizes that it has no intention of using the pipelines to compete with tanker transportation, and PAW reiterates its statement that the pipelines will be declared surplus as soon as it becomes possible to return to normal means of transportation. This was expected to be within 30 to 60 days (*see NPN Aug. 29, p. 34*).

### Purchasers Reimbursed

In a statement accompanying its announcement of reduced rates, RFC said it had paid purchasers of petroleum along the eastern seaboard—including purchasers from the two pipelines—their costs in excess of those which would be incurred if the oil were moved in the normal way.

But in view of the termination of the revenue price increase of Sept. 1, RFC added, it is necessary to reduce the pipeline tariff to a rate which is equivalent to current war shipping tanker rates.

The new rates are 43c per bbl. for crude, 40c per bbl. for gasoline, and 42c for heating oil, with gathering charges on crude of 14.7c per bbl. from the East Texas field, 14.1c from the Southwest Texas field, and 26c from the West Texas field. Old rates were 80c per bbl. on crude and 65c per bbl. on gasoline and heating oil.

## Surplus Property Board Stops Allocating Trucks to Farmers

NPN News Bureau

WASHINGTON—The Surplus Property Board has abandoned its program of allocating surplus Army trucks to farmers, largely because reconversion and the prospect of buying new trucks have dimmed farmers' interest in the used vehicles.

Acting on a recommendation of Secretary of Agriculture Clinton P. Anderson, SPB announced that farmers who wish to buy surplus trucks now should contact local truck dealers, as vehicles will be disposed of through normal channels, with no need for certification.

## Rumania and Russia Get American Oil Experts

NPN News Bureau

NEW YORK — John Fincke of Standard Oil Co. (N. J.) will probably be the first civilian representative of an American oil company to enter Rumania, it appeared this week as Mr. Fincke was awaiting transportation to Europe.

Many applications for permission to visit Rumania are on file with Allied authorities, but so far as is known here, the official granting of such authorization has been given only to Mr. Fincke. He is a member of the staff of Ralph Bolton, who is manager of production of Jersey Standard in Europe and the Near East.

As Mr. Fincke was preparing to sail, Eugene J. Houdry, president of the Houdry Process Corp., and Arthur V. Danner, executive vice president of the company, together with several associates, arrived in Moscow to discuss operations of the Houdry catalytic cracking facilities being installed in Russia. The trip is being made at the request of the Russian government with the approval of the U. S. State Department.

A special commission of Russian petroleum experts visited the United States in 1942 to investigate possibilities of providing aviation gasoline facilities in the U. S. S. R., and eight Houdry catalytic cracking units were ordered for Russia under lend-lease arrangements. Construction of equipment to produce approximately 25,000 b/d is nearing completion.

## Convention Dates Announced Following Lifting Of Ban

NPN News Bureau

CLEVELAND—With the announcement last week of additional steps by ODT liberalizing its ban on conventions, many associations announced dates of forthcoming conventions. Others are still in the tentative stage, so far as the exact time or spots where they will be held. But conventions are definitely back on the oil men's calendars.

One association secretary, K. C. King, executive secretary of the Wisconsin Petroleum Assn., advised NPN that exhibits will also be held this year in connection with the convention.

Convention dates are listed on p. 53.

ODT in announcing the liberalizing of its convention ban, said that national, regional, and group meetings still require committee approval if attendance tops 150 persons from outside the state where the event is held. This places state conventions back on a prewar basis, since the provisions provide that state and group meetings may now be held without the necessity of obtaining committee approval, provided attendance is confined to persons residing in or engaged in business within the state in which the event is held, plus not more than 25 persons, such as speakers and honored guests from outside the state.

Trade shows may also be held, after clearance with the committee, if attendance, exhibits, entries and exhibitors are drawn from within the states where the show is held. However, applications must still be filed for all trade shows.

## Hughes Tool, Seized by Army, Is Returned to Its Owners

*Special to NPN*

HOUSTON, Tex.—The big Hughes Tool Co., peace-time manufacturer of oil field equipment, has been returned to its owners by the Army after being seized a year ago after a labor dispute with the United Steelworkers of America (C.I.O.).

The announcement was made by Col. Ora M. Baldinger for the War Department. Tom Mobly, industrial relations manager for the firm, said the return was without advance notice and that the Army "just took down their flag and walked off."

Frank A. Hardesty, district director for the steel workers, said a contract was still to be signed with Hughes and that the management and union were still apart on four issues: seniority, maintenance of membership and the check-off, hours of work, and shift differentials.

The company's contract with the union expired in April, 1944, and as is customary, the terms of the old contract were extended by the War Labor Board while the plant was under operation by the Army.

Hardesty said it was the company's refusal to comply with a WLB order regarding maintenance of membership and check-off that precipitated the Army seizure.

The Army is still in charge in three other Texas industries: Humble Oil & Refining Co.'s Ingleside plant, The Texas Co.'s plant at Port Arthur, and the Sinclair Rubber Co. plant at Houston.

## RFC Maps Windup Procedure On Petroleum Adjustments

NPN News Bureau

WASHINGTON — A program for eventual elimination of compensatory adjustments under Petroleum Compensatory Adjustments Revised Regulation 1 has been announced by RFC, with PAW and OPA concurring.

Applicants are notified that:

(1) Compensatory adjustments will be discontinued as soon as transportation and distribution of petroleum and petroleum products can be reconverted to a substantially normal basis. While it is impossible to specify at this time the actual date on which the regulation can be entirely revoked, it is not likely that compensatory adjustments will be made for a longer period than 60 days. Applicants will be notified in advance of date of termination.

(2) Compensatory adjustments will not be made for excess costs incurred on any importation or inter-supply area movement of crude, compensable products or miscellaneous products which is commenced on or after Sept. 1, or any such movement not completed prior to Oct. 1, unless the movement is made pursuant to a shipping schedule approved by PAW, or unless the movement has been approved in advance by PAW.

Termination of compensability of intra-supply area movements will be the subject of a later notice. All outstanding intra-district movement approvals are cancelled, effective as to movements commenced after Aug. 31.

(3) Compensatory adjustments will not be made for excess costs incurred on any movement of miscellaneous products, as defined in section 1 (G) of the regulation, which is begun on and after Sept. 16, nor in any movement which is not completed prior to Oct. 1.

(4) Maximum prices for compensable products in cases where they have been previously established by OPA will be reduced by that agency, effective Sept. 1, except at retail establishments. Revised maximum prices at retail establishments will be made shortly.

## Petroleum Club to Sponsor Veteran Educational Program

NPN News Bureau

CLEVELAND—Plans are being made by The Petroleum Club of the Cleveland Chamber of Commerce for members to work with wounded veterans at Crile hospital here in giving them advice and counsel on service station operation.

Prof W. G. Seitz of Fenn College, who has been conducting a program of recreational therapy at Crile hospital, said that many of the wounded veterans were eager to acquire knowledge about the operation of gasoline service stations, and suggested that the Petroleum Club sponsor such a program.

Louis S. Peirce, chairman of the Club's public relations committee, and Chas J. Thomas, executive secretary, are developing the plans. The Army handbook "How to Get Into the Service Station Business", will probably be used as a manual by club members in their work with the veterans.

## RFC Leases Toluene Plant to Humble on Interim Basis

NPN News Bureau

WASHINGTON — Reconstruction Finance Corp. announced this week it has negotiated an interim lease with the Humble Oil and Refining Co. for a toluene plant near Baytown, Tex., which Humble operated during the war.

RFC said it would continue to receive bids for sale or lease of the plant as surplus property during the term of the lease, not to exceed 90 days. Humble will produce for civilian markets.

# Editor's Page

## St. Louis Newspaper Strike Raises Threat To Oil Industry's Station Relationship

THE main point that seems to be continuing the big newspaper strike at St. Louis is one that might have come up in past years in the oil industry and which may easily arise in oil marketing in the future.

That point, expressed in oil marketing terms, is: Can service station operators, holding their stations through lease or ownership, band themselves in a union or join another labor union, and have that union negotiate a contract with their suppliers as a group covering all the conditions of business between the two including size of margins or discounts on gasoline and lube oil, and discounts or purchase prices on accessories? In other words, make a contract that affects price.

In St. Louis, the paper carriers or distributors, through their union, want to negotiate contacts covering margins and purchase prices of papers, as "employes" and at the same time continue themselves as "independent merchants". Three firms of attorneys have advised the publishers that they cannot sign such a contract with the union if its members are in fact "independent merchants" without being liable to prosecution for violating anti-trust laws in that they have agreed on price thus restraining competition. In addition to anti-trust proceedings the newspaper publishers would be laying themselves open to all sorts of rulings by all the government agencies and laws set up to control hours, wages, security insurance etc. for violations of which triple damages can be sued for.

### Union Insists Upon Being Both

The publishers have asked union members to decide which they will be, saying they will deal with the union if its members actually become employes or if they be "merchants" then the publishers individually will deal with their own distributors through the latter's chosen representatives. But the union insists on being both and refuses to take the necessary legal steps to permit the publishers to get into court and have a protective legal interpretation made.

As the carriers are affiliated with the pressmen's union, the other union employes of the papers refuse to "cross the picket line" and the town's three leading newspapers have been closed up since Aug. 16th.

At different times and in various parts of the country in past years, labor unions and agitating individuals have organized "unions" of service station employes and also of the station operators, lessors or owners, and then have tried to bargain with the suppliers. But the "unions" thus organized were always weak especially when they included the independent station operator or owner. Outside of being irritants and providing the organizers jobs, nothing ever came of them.

### Drives Already Have Started

However, with the wide open strong-arm drives of labor unions today, and especially if this paper distributors union at St. Louis wins its battle there, it may fairly reasonably be concluded that the unioneers will turn more of their attention again to the service stations. Drives have already started at some points, such as Minneapolis, recently.

If the unions, at least with their present low standards of service to the country and their present utter disregard for the rights of others and the public, get hold of service station employes and operators, the oil industry will be set for a mighty serious time to develop much of its old time good service to the gasoline consumers. It is one thing to have unions in the production end of a business but it is something else entirely to have them contacting your customers as your salesmen and your only service representatives.

### It Would Be a Headache to All

With all the big turnover in station men and operators, due to varying abilities, types of stations, character of communities and volumes of gasoline throughput, it will certainly be a headache to all concerned, including the customers, if the industry has to undertake to control and discipline all these hundreds of thousands of representatives through or in conjunction with a labor union. Proving to a union committee the inefficiency of a factory worker whose product may be susceptible to some measurement is a bad enough job, but how about proving the inefficiency of a sales representative at a service station to such a committee? The offended customers, who are going elsewhere for their gasoline, are not going to be interested in any alibis or whitewashing by a union committee of a station man whom these customers do not like. If these disgruntled customers see an unwanted man, one whose service they do not like, "re-instated" at a station through the efforts of a union committee, it is dollars to doughnuts the customers are not going to pause and try and make themselves admit that maybe they, the customers, were wrong. No, they will just drive on down the street and, if necessary, make sure that the station they do finally patronize is not a union run station.

### See That the Record is Clear

Right there may be the answer to such a possible problem to the oil industry, especially if this St. Louis controversy should put the union in the saddle. The oil industry can make sure that its relationship and operating set-up in regard to all leased out stations and those actually independently owned and through whom it sells are recognized by the courts and public as truly independent units. If such units do band themselves together for mutual advantage, then the companies can see that the record is so clear that they too will be subjected to the same laws governing independent business units as are the gasoline suppliers.

READERS' comments and opinions will be much appreciated by Warren C. Platt, NPN's Editor and Publisher, Penton Building, Cleveland 13, Ohio.

*Washington—By Raymond E. Bjorkback, Substituting for Herbert A. Yocom*

## Surplus Drama Giving RFC Landlord's Role, Not Merchant's in First Act

**In the absence of Herbert A. Yocom, chief of NPN's Washington bureau, Raymond E. Bjorkback, a member of NPN's Washington staff writes this week's column from the national capital**

WASHINGTON—The curtain is only newly risen on the surplus property disposal drama, but from here it looks as though no one should be surprised if the government appears more in the role of the landlord than that of the merchant of capital and producers' goods — at least through the first act.

Mr. Bjorkback

For one thing, of course, you don't lightly let go an avgas plant, say, or a butadiene plant. You don't, certainly, if you're the Reconstruction Finance Corp. and have to aim at the objectives of the Surplus Property Act in its present form.

Not only does RFC, under the act, have to sell or lease as promptly as feasible without fostering monopoly or restraint of trade, or unduly disturbing the economy. It has to, among other things:

1. Contribute to expansion of that economy (keep plants operating).
2. Contribute to maximum employment ("full employment," if you please).
3. Strengthen the competitive position of the small business concern (give preference to local, independent capital).

RFC already has given some indication of its inclination in this cramp. Cancellation of avgas contracts has set it planning to lease the 100-octane plants on a month-to-month basis to give present operators opportunity to decide whether they'll exercise their purchase options.

Generally speaking, there's not much doubt about who'll buy—eventually—what avgas plant. But an operator has 90 days after cancellation of his contract in which to exercise his option. Then, he has another 90 days in which to exercise a "refusal" privilege in negotiations.

Further, if the facility in question cost the government more than $5,000,000 to install, a report outlining the economic problems involved and setting forth a plan or program for disposition must be made available to Congress for 30 days while that body is in session before transfer of title — apparently — could be effected. The act is not clear as to what might be done if Congress fails to act on such a report.

Considerable time could elapse, therefore, before final disposition. Meanwhile, RFC might be collecting rent.

Also, when an agency like the War Department declares a facility "in excess of needs," the property is not to be declared surplus before all other agencies which conceivably would have use for it have been polled. Perhaps a "stand-by" status is indicated for a plant. RFC officials feel their course in cases like these is clear—lease, if at all possible.

While they emphasize that dispositions will be made on an individual case basis, it is not unlikely that they will handle plants in the synthetic rubber program similarly, especially in view of the fact that rubber is a matter for "high policy," extending through the military and the State Department, right up to the White House.

Pipelines, of which RFC has four besides Big Inch and Little Big Inch, are a slightly different matter, cradled already in something of a welter of proposals. However, they are subject to the same provisions of the act.

Further, it is not inconceivable that elements of the New Deal with continuing influence might attempt to persuade the government to exercise its privilege of first call on these facilities.

There is, as a matter of fact, a full-fledged school of thought here which holds that the government should retain ownership of the several sizable war-spawned facilities which now are RFC's headache.

RFC officials, themselves, exhibit a consciousness that they are pioneering in new social-economic territory. They're treading cautiously. So friendly a sight as a prospective purchaser of surplus property will evoke a bright gleam in their collective eye.

The welcome stranger will be told with alacrity that they're ready to talk business now on a "when-as-and-if-it-becomes surplus" basis.

But he is likely to find them doing a deal of stuttering and showing definite symptoms of motor paralysis if he is interested in buying something big. He is more likely to go home with a provisional lease in his pocket than a title.

*East Coast—By Frank P. S. Glassey*

## Skillful Rule of Charles L. Harding Prepares Dist. 1 for Graceful Exit

NEW YORK — PAW's Dist. 1, along with all other district offices, is about to fold up. Its going will leave a void that will gradually fill. But the departure of Charles L. Harding, director-in-charge, will be a distinct loss to Government, even while it is a gain to the industry.

Mr. Glassey

Mr. Harding plans to return to Socony-Vacuum, which he left in January of this year to take the post that had been tragically vacated by John D. Collins, who died after a heart attack. Mr. Harding answered an emergency call, and the industry will always have reason to be grateful that he did.

It is hard to imagine a government agency functioning any more smoothly than has the local office of PAW in the last few months. One of the first policies adopted by Mr. Harding was that of full publicity, so long as no military secrets were involved. He has maintained that policy during the last seven months.

It is refreshing to see someone in government service, even if his tenure of office is only temporary, act like a human being. Just as it is disturbing to come in contact with those who take themselves too seriously, so it is an unexpected and pleasant surprise to deal with some one in authority who appreciates the dignity of his position, but realizes that he is serving the public at the same time. That's the sort of man "Charlie" Harding is.

Back in January, 1942, he joined PAW as district counsel, and a month later he was named director-in-charge here. In September, 1944, he resigned to join the legal staff of Socony-Vacuum. He obtained leave of absence from that company on Jan. 25, 1945, to succeed Mr. Collins.

Only 39, Mr. Harding is a young veteran of the oil industry. After a law degree at the University of California, he became manager of the legal department of Shell Oil Co. for the territory east of the Rockies. He is a member of the California and New York bars.

Through his stay at PAW here Mr. Harding conducted weekly staff meetings at which he not only invited, but welcomed, all shades of opinion on methods of operation. He evidenced particular interest in the belief that the office was a government agency, and that in that respect it should given the public complete information on its activities.

Mr. Harding said last week that about half the members of his office would return to private life by the end of September, and that most of the others

would be out by the end of October. He predicted that Directive 59 would end by Oct. 1. "PAW," he said, "will be back on a peacetime basis by the first of October."

* * *

French oil experts are "cautiously optimistic" about prospects for an increased supply of native petroleum in France—or so the French Press and Information Service says. The statement adds: "They hesitate to give the impression that recent discoveries can be counted on to alleviate France's present drastic fuel situation."

The report added that French geologists believe that rich oil pools, yet untapped, may exist between the Rhone River and the Atlantic Ocean, and from the lower boundaries of France's central plateau to the Pyranees. "They also feel," says the service, "there is a strong likelihood that Aquitania, the section of France lying between the Garonne River and the Atlantic Ocean, may prove a fertile new source of oil."

* * *

Representatives of American co-operatives who will attend a conference in London this month will see the establishment of a petroleum co-op to be operated for the benefit of the members in 41 countries under the auspices of the United Nations, it was announced here by Howard A. Cowden, president and general manager of the Consumers Co-operative Assn., whose headquarters are in Kansas City.

Mr. Cowden traced the development of the Co-operative Refinery Assn., and said that the advantages that had accrued to the country's farmers since the association set up its first refinery six years ago "might well be extended to members of co-operatives in foreign lands."

* * *

No one needs to be told that there is a tourist boom on, now that gasoline rationing has ended. Yet this fact was emphasized last week when the local headquarters of Colonial Esso Marketers Touring Service revealed that within the two weeks before Labor Day, touring information requests were 100% above a year ago. It was estimated, however, that they were only half as heavy as before the war.

Within five days of the lifting of gasoline rationing, requests for information at the office skyrocketed 54%.

## PIPELINES — NPN Writers at Three Vital Points Discuss the Industry's problems

*Midwest—By F. B. Caldwell, Substituting for Earl Lamm*

# War Clipped Oil Heating Industry's Wings, but It Is Ready To Soar Now

CHICAGO—The accomplishments of the automatic oil heating industry, prewar, in establishing itself pre-eminently in the field of purveyors of automatic heat, entitled it to the wings it so proudly wore. With war and the necessary restrictions of wartime production those wings were clipped.

Mr. Caldwell

**F. B. Caldwell, secretary of the distribution division, Oil Heat Institute of America, Inc., and of Burning Oil Distributors Assn. of Chicago and Chicago Oil Burner Assn., substitutes this week for Earl Lamm, chief of the NPN Chicago news bureau, who is on vacation**

In view of the tremendous demands of the armed forces, limitations were quickly imposed on the manufacture of heating equipment, particularly equipment for the use of oil. Followed then the program for conservation of fuels, which under pressure of wartime need for speed, resulted, in the case of oil heating equipment, in a program of conversion to the use of other fuels.

The declared need for fuel oil rationing raised doubts in the minds of the public as to the available future oil supply, postwar. Requirements for exceptions to an order prohibiting the use of oil for additional facilities, even where hardship existed, made fuel oil "hard to get". However, more and more people became fuel oil-conscious. Then came the capitulation of Germany, the final war end and the finish of fuel oil rationing.

Limitation orders affecting the industry were quickly revoked and the industry emerged with a suddenly new found freedom.

Overnight, in actual fact on V-J day, orders for oil heating equipment started rolling in to dealers. This new freedom brought a realization of a responsibility in connection with two questions: should industry let freedom ring the bell for an all-time high in new sales chalked up for new burners for new and eager customers? Should industry consider the replacement needs for the old customers with worn-out burners, some of them due for replacement at the start of war? The oil heating industry recognizes its responsibility to both old and the new customers. This responsibility will be met, but it is going to take co-operation, patience and consideration of over-all needs.

Oil men and burner men co-operated in prewar days. The two, combined, have evolved a new industry which finds itself today with approximately 2,400,000 units now installed and to be supplied with oil and maintenance service. This new industry is now confronted with the additional task of supplying the needs, preferentially for oil heat, of the former oil heat users who want to convert immediately, as well as users of other fuels who now declare their preference for oil, and, in addition, the needs of dwellers in new homes yet to be built.

Manufacturers are conscious of their industry's new freedom. Their problem is materials and manpower to meet the demand. Distributors and dealers cannot lose sight of this new freedom because of orders pouring in. The petroleum refiner is mindful of the expanding market possibilities of fuel oil, but must be kept conscious of the timing of developments in order to assure a supply of the required types and quantities of fuel oil for the indicated demand as it develops.

While there is freedom to exploit as well as to expand on a sound basis, there are many reasons to justify the belief that both the oil and burner people intend to build the postwar oil heating business on a firm foundation. For example: the prototype burner of tomorrow, being developed now by the burner manufacturers under a program sponsored by the Oil Heat Institute of America in co-operation with the large oil refiners.

This burner, to be tested out with prototype oils of tomorrow, will evolve the postwar, efficient economical oil burner to meet the expanding need for oil heating. The public's renewed confidence in oil and in American ingenuity puts the responsibility upon the oil heating industry to deliver nothing but the best.

The public is now well disposed toward oil. Impressed by the vital role of oil in the prosecution of the war, it has taken note of the fact that the petroleum industry is capable of rising to meet any emergency, and of delivering the goods where needed and for the purpose required.

This has bred confidence in oil and has made the oilheating industry well disposed toward living up to the public's expectations. We may well conclude that public relations with oil heating will be promptly and efficiently re-established on a mutually satisfactory basis.

Oil heat does not have to be sold on a price basis, as the public is not likely

to be price-conscious of either oil heating equipment or fuel oil costs. Why should it be? Fair treatment has been accorded old customers by the industry in the past. New customers are lining up, impressed by oil's accomplishments in the war and fairly disposed to low-cost oil heat. With the public willing to pay for what it wants and the industry, with its expanded facilities, competing to provide better burners and better oils, oil heat can set its sights high, recover its losses and head for gains to which it is entitled.

As to the supply of "Oil for Tomorrow", news of the construction of the "Big Inch" and other pipelines, was announced to the public together with news of the development of better petroleum products to meet the war emergencies. Confidence in the ability of the petroleum industry and in the ability of America's manufacturers to produce improved oils and new products is justifiable in the minds of the public, based upon past performance. The responsibility rests with the oil heating industry for justifying continued public confidence. The chances seem in favor of the industry meriting the confidence of the public, which will provide new horizons in possibilities for expanded markets and profits.

The petroleum chemist has had some tough assignments but has always come through. Given the job of developing better fuel oils he will deliver. Burner manufacturers, unrestrained and unrestricted will rise to the opportunity of developing improved products in their own natural line of endeavor. The oil heating industry has it wings again. May its new found freedom ring a new high note in accomplishment.

## Jersey to Build in Rockefeller Center

NPN News Bureau

NEW YORK — Standard Oil Co. (N. J.) is planning the erection of a 33-story office building in Rockefeller Center, as soon as construction materials are available, it was announced here last week.

The announcement was made by the Haswin Corp., an agency of John D. Rockefeller, Jr. The estimated cost is $6,000,000.

It is expected that construction will require a year. All space in the new building above the second floor will be leased by Jersey Standard and will be used by it to consolidate six offices, now at 26 Broadway, 15 Broad Street, 115 Broadway, 74 Trinity Place, the Empire State Building and 32 Broadway. Nine floors in the R.C.A. Building at Rockefeller Center now occupied by the parent organization will be retained.

The new structure, to be known as the Esso Building, will be erected between West 51st and West 52nd streets, just north of Rockefeller Center. Two entrances will be connected by a spacious lobby in which will be an information and products display center of Jersey Standard. A bank has leased space on the street floor.

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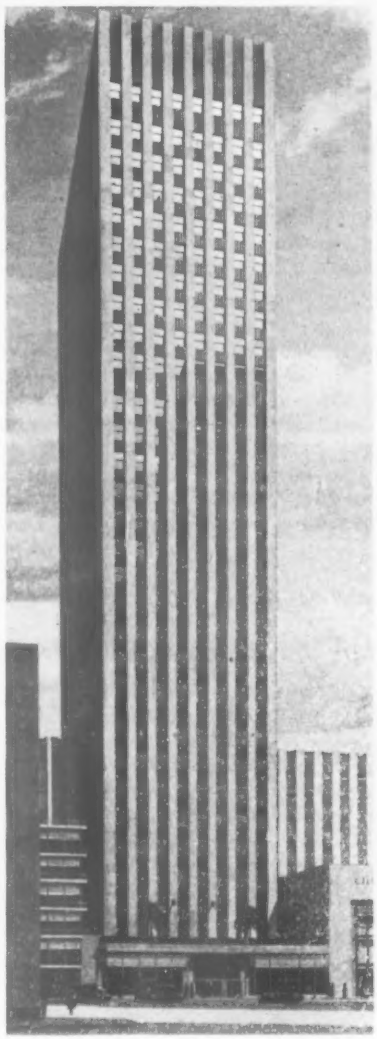


**Architects' sketch of proposed 33-story Esso Building, to be erected between West 51st and West 52nd Streets in New York City. Standard Oil Co. of New Jersey will occupy all space above second floor**

Why put off all maintenance and repair because some materials are hard to get? . . . See page 24, "NPN Check Sheets."

## British American Buys Union Oil of Canada

*Special to NPN*

VANCOUVER, B. C.—British American Oil Co., Ltd., has announced through its president, W. K. Whiteford, the purchase of the business and physical assets of the Union Oil Co. of Canada. Union Oil of Canada is a wholly-owned subsidiary of Union Oil of California, and has been one of the large marketers of petroleum products in British Columbia and Alberta.

By the deal, British American extends its marketing activities from coast to coast and the busines accruing through the acquisition will establish it as one of the leading independent Canadian marketers of petroleum in British Columbia.

British American is a completely integrated company. Crude oil is processed in five refineries located at Montreal, Toronto, Clarkson, Ont., Moose Jaw and Calgary. According to the company's latest financial statement which covers operations for the year 1944, the oil company's assets are in excess of $67,000,000. Issued capital stock consists of 2,772,642 shares owned by approximately 19,000 shareholders living in every province of the Dominion.

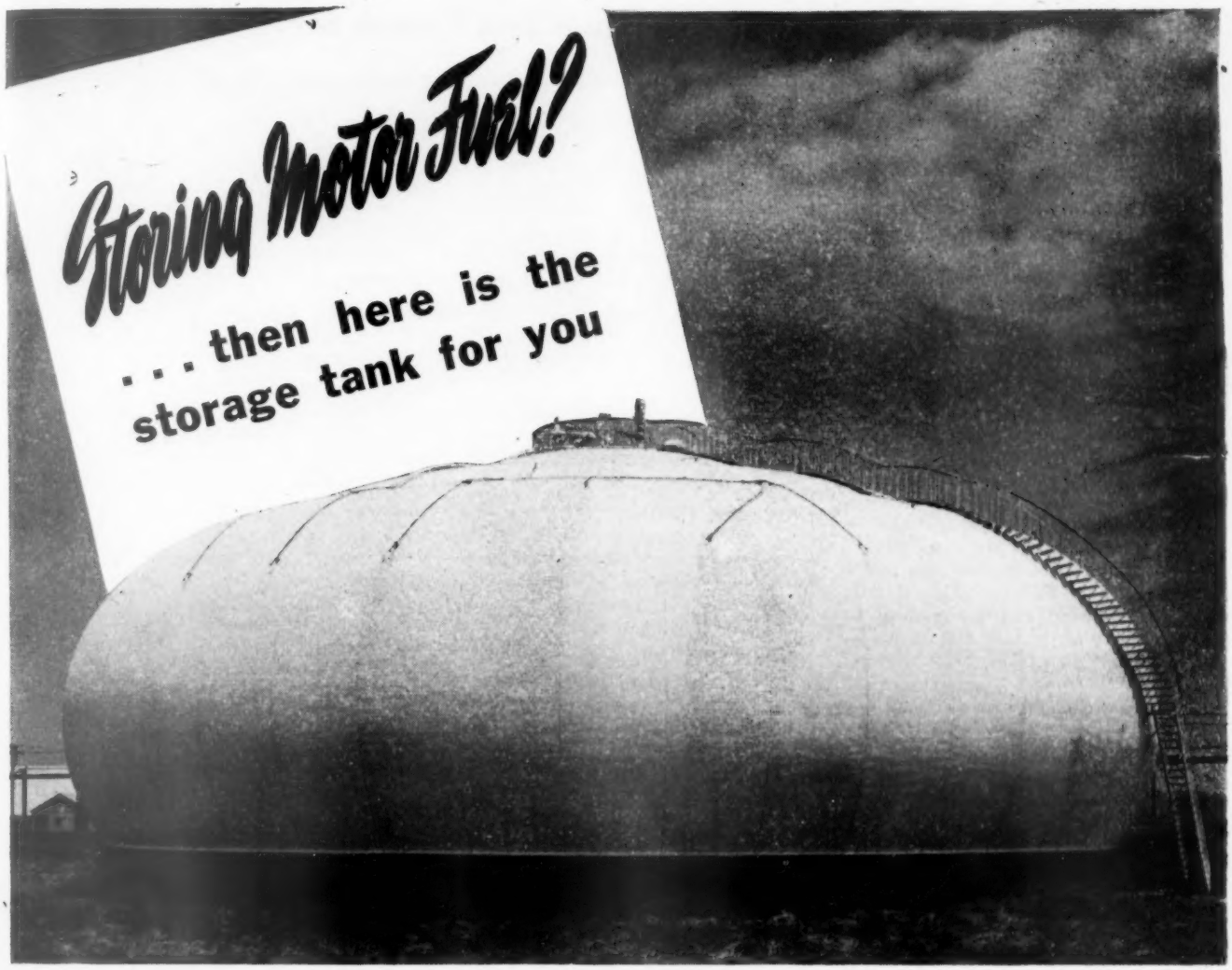
### Plans Pipeline to Carry Gas From New Pool in Texas

*Special to NPN*

MARSHALL, Tex. — An outlet for gas produced from the Harleton area of Harrison County appears in the making with reports that the Arkansas Louisiana Gas Co. is planning to lay an 18-mile line from the new pool to Daingerfield in Morris County.

Two wells have been completed in the field and a third is drilling. Arkansas Louisiana is negotiating for purchase of all the gas produced in the field. The company also plans to build a station at Harleton and a telephone line along the pipe line.

No booster plant will be necessary to push the gas through the line as the wells so far completed have a rock pressure of 2500 pounds.




Profits can be made or lost at marketing terminals, depending upon whether or not steps are taken to prevent evaporation. Pressure storage is the logical way to stop evaporation loss. That's why so many operators use Hortonspheroids. These large capacity tanks reduce evaporation due to *breathing*, *boiling* and *filling*. They are usually designed to operate at higher pressure than the vapor pressure of the products being stored during the normal temperature range and are equipped with relief vents set to open above this pressure. Hence, instead of allowing a portion of the air-vapor mixture above the liquid in the tank to escape each time the temperature increases, pressure is built up inside the tank. No evaporation loss will take place as long as this pressure does not exceed the setting of the relief vents.

Hortonspheroids of the smooth type are available in capacities from 2,500 to 40,000 bbls., for 5 to 35 lbs. per sq. in. pressure. Noded Hortonspheroids, like the 80,000 bbl. installation shown above, are built in capacities of 20,000 to 120,000 bbls. for pressures of 2½ to 20 lbs. per sq. in.

*Here's proof of the Hortonspheroid's efficiency. A 50,000-bbl. Hortonspheroid, storing motor gasoline and operating at 2½ lbs. per sq. in. pressure, will lose 50 bbls. by evaporation during each complete filling. There will, however, be no day-to-day breathing loss. If the same product were stored in a gas-tight, fixed roof under the same conditions, the filling loss would be 100 bbls. each time and the annual breathing loss would amount to 1,300 bbls.*

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Philadelphia 3.....1614-1700 Walnut St. Building
Los Angeles 14.....1422 Wm. Fox Building
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# Oil Industry Engineers Manage Fuels and Lubes for Ordnance

## Branch Prepares Instructions on Use of Fuels, Lubricants and Equipment; Solves Problems of Maintenance and Supply


### By Maj. Walter H. White

*Assistant Chief, Fuels and Lubricants Branch, Army Ordnance Department; on Military Leave from Standard Oil Co. of New Jersey*



*By Warren C. Platt, Editor*


The Ordnance Department, having become the vast machine shop of the army responsible for keeping all equipment other than Air in repair, has also become the greatest military consumer especially to technical petroleum products. Here every conceivable type of lubricating problem is encountered in all types of engines for both mobile field equipment and for shop operation, and for all types of bearings.

As the maintainers of all army equipment, other than Air Corps, Ordnance also was given the job of preserving that equipment from the elements of weather, high and low temperature and from immersion in sea water on beach landings.

So under the Chief of Ordnance there was early assembled and built up as the volume of equipment grew, a group of top oil industry technical men. Their chief was always an oil lube expert of years of experience, the present chief being Lt. Col. Warren C. Landis who got his oil training with Shell.

These Ordnance Tech men have been all over the war theaters as well as back at home among the manufacturers of the equipment. They have also worked through oil tech men on special assignment to the theaters and armies. So these oil men from Ordnance have worked at desks and out in the field, have slept at home and under pup tents and in fox holes, all up and down the fighting lines in Europe and out the far Pacific and in "CBI"—China-Burma-India—as well.

Here is a short outline of their place of importance in seeing that oil did its job in this war. It was written by Maj. Walter H. White, assistant to Col. Landis and an engineer with the Standard of New Jersey.

The Fuels and Lubricants Branch, Maintenance Division, Field Service of the Ordnance Department, ASF, comprises seven officers, three civilian engineers and one part time Technical Consultant located in the Office, Chief of Ordnance-Washington with two officers directly handling automotive work in the Office, Chief of Ordnance-Detroit. Of these, eight officers and one civilian engineer came directly from the oil industry and one officer from the lubricating equipment industry.

The Fuels and Lubricants Branch is now headed by Lt. Col. W. C. Landis who was an industrial engineer with the Shell Oil Co. Inc. prior to entering active duty in the Army. His assistant is Major W. H. White, formerly with the engineering division, sales department, Standard Oil Co. of New Jersey.

The Fuels and Lubricants Branch handles all Field Service problems concerning fuels and lubricants and lubricating equipment insofar as guns, general purpose and combat vehicles, fire control instruments and all other Ordnance equipment are concerned.

### Prescribe Preservative Oils

Many varied duties are performed, one of the most important being the preparation of all instructions concerning the use of fuels, lubricants, lubricating equipment and preservative oils and compounds. This involves not only providing the fighting troops with information on what to use, but also instructing them on how to apply the materials and how often. In conjunction with this activity, the Fuels and Lubricants Branch is responsible for adding new fuels and lubricants to Ordnance Supply Catalogs, deleting obsolete items and combining these materials into one item where possible.

Since petroleum products are of no use unless the means are available for applying them easily, quickly and thoroughly, lubrication fittings, lubricating guns and all other lubricating devices must also be provided. All responsibility for standardization of lubricating equipment for all equipment used by the Army ground forces, in addition to Ordnance materiel, is a major activity.

In order to insure that the petroleum products prescribed and supplied are performing satisfactorily, widespread surveillance is carried out. Fuels and Lubricants Branch representatives travel throughout the Army both in the United States and overseas to determine that fuels and lubricants and preserving materials are performing as intended and to detect any faults which need correction either by change of instructions, material, frequency of application or design of equipment.

An additional responsibility which has taken on extreme importance during this global war is that of proper preservation of guns, vehicles and spare parts, both during the long sea voyages and in storages in this country and abroad. The selection of adequate preservative oils and compounds and prescribing of their use in conjunction with the boxing and packaging organizations of the Ordnance Department, ASF is a large activity. Here again, surveillance must be carried out in order that Ordnance materiel will reach the fighting front in good condition and be capable of being used against the enemy promptly and without extensive overhauling or other preparation.

Although considerably removed from petroleum products in composition, such materials as paints, cleaning compounds, sand paper, sponges, etc. are considered equal in importance in preserving and maintaining Ordnance materiel and are likewise the responsibility of the Fuels and Lubricants Branch. Also in this classification are such materials as oil filters and all types of soldering, welding and brazing supplies. Accomplishments of these duties has carried representatives of the Fuels and Lubricants Branch to Panama, Alaska, China, India and Europe.

In addition, numerous officers who have come into the Fuels and Lubricants Branch from the oil industry have helped carry on its work and have then gone on to all of the various war theaters to carry on various phases of petroleum supply and application activities in these theaters.

### Saw Need for Trained Personnel

The Fuels and Lubricants Branch antedates all other similar activities in the Army ground forces. Early in 1940, before the entry of this country into World War II, the Ordnance Department recognized the need for personnel particularly trained in the proper use of petroleum products, especially fuels and lubricants. Fuel and lubrication considerations were formerly loosely assigned and the need for coordinated use of standardized fuels and lubricants in the large quantities of new equipment being developed was recognized.

These duties were assigned to 2nd Lt. (later Major) G. H. Schoenbaum, who was ordered to active duty from the sales department, engineering division of the Standard Oil Co. of New Jersey. Much was accomplished and increased responsibility gradually resulted in the building up of the activity until four officers and two civilian engineers were necessary at the time of the United States entry in World War II. Shortly after the beginning of 1942 two more officers were assigned.

During this period between 1940 and 1942, coordination of fuels and lubricants instructions in Ordnance and other manuals was accomplished to a large degree, resulting in the number of different fuels, lubricants and preservative oils and compounds being reduced from ap-

*Two Sales Engineers Who Have Handled Oil Problems in Army for More Than Three Years*

**Maj. William A. Howe entered on active duty in October 1941 and has served in the following capacities, among others, while in the Army: officer in charge, limited 4th Echelon Shop, Fairbanks, Alaska; assistant automotive officer, Alaska Defense Command; officer in charge, Petroleum Division, Alaska Highway; Director of Supply, Alaska Highway; lubrication and preventive maintenance inspector to commanding general, Northwest Service Command; and chief, Surveillance Section, Fuels and Lubricants Branch.**

**In addition, Maj. Howe served on temporary duty in the India-Burma and China Theater on fuels and lubricants problems on the Ledo and Burma Roads.**

**Prior to entering on active duty, Maj. Howe was employed in the sales engineering department of the Standard Oil Co. of New Jersey, New York City. Previous to that, he worked in the laboratory for the Standard Oil Co. of New Jersey and Cities Service Oil Co. Major Howe graduated from the Missouri School of Mines and Metallurgy in 1935.**

**Capt. Robert W. Carr reported for duty in April 1942 as a 1st Lieutenant. He was first with the Resources Division, Headquarters, S.O.S. (now ASF) where his duties involved initiation and coordination of petroleum standardization within the War Department. Later in 1942, he was transferred to the Ordnance Department, ASF, where he performed the duties of Fuels and Lubricants Engineer to all continental United States Ordnance arsenals and depots. Early in 1944, he received his present assignment as assistant chief, Fuels and Lubricants Section, Maintenance Division, Office, Chief of Ordnance-Detroit. Here his duties parallel those outlined for the Fuels and Lubricants Branch in Washington, with particular reference to automotive equipment.**

**Before entering the Army, Capt. Carr was in the retail and industrial lubricants sales departments of the Standard Oil Co. of New Jersey and Colonial Beacon Oil Co., during which time he studied chemical engineering at New York University.**

proximately 250 to 37. The elimination of maintenance and supply problems which were affected thereby will be obvious to all oil and maintenance men.

Also, during this period, the first steps were taken to provide heavy duty motor oils for Ordnance engines. Here advantage was taken of the several years experience of the petroleum and engine industries with these oils and they were immediately adopted for use in Diesel engines in Ordnance equipment. Continued work with the oil and engine industries eventually resulted in U.S.A. Specification 2-104 which is now the standard oil used throughout all Army ground equipment. At the same time, it was found possible to standardize grades of this oil to SAE 10, 30 and 50 for all purposes.

Concurrently, standardization and elimination of numerous grades of gear oils and greases was started and eventually this also was extended to all Army ground equipment.

In accordance with the Ordnance Department's original intention that fuels and lubricants should receive proper consideration from the time Ordnance equipment was in the development stage, in 1941, one officer, Lt. R. E. Jeffrey, formerly with the Shell Oil Co. Inc., was assigned to research and development work. His activities have increased until he is at present a lieutenant colonel and is in charge of a Fuel & Lubricants Branch concerned solely with the development phase of Ordnance and Army fuels and lubricants.

In the work of providing concise standardization lubrication instructions, it was decided again to use the experience of the oil industry and adopt the type of lubrication chart commonly used in service stations throughout the country.

This work was contracted to the Chek-Chart Corporation, whose engineers worked with Fuels and Lubricants Branch personnel to develop lubrication diagrams for all Ordnance materiel. This form of lubrication instruction was gradually adopted by other services of the Army until at the present time it is the standard means of providing lubrication instructions, and the form and contents

*All photos illustrating this story, except that of Capt. R. W. Carr, are from the Army Signal Corps.*

*They Apply Their Petroleum Industry 'Know-How' to Army Fuels and Lubes Problems*

**Capt. Edgar H. Berg was employed by Standard Oil Co. of New Jersey after leaving Rensselaer Polytechnic Institute in 1937 with degree of master of Chemical Engineering. From 1937 to October 1941 his principal activities were with technical service division at Bayway Refinery, New Jersey.**

**Capt. Berg entered on active duty with Quartermaster Corps in October 1941 as a second lieutenant at Holabird Quartermaster Depot. In March of 1942 he went to the California desert as a member of the Quartermaster Desert Test Command at Camp Seeley. This command later became the Ordnance Desert Proving Ground where Capt. Berg remained on duty until February 1944 when Ordnance Desert Proving Ground was inactivated.**

**Capt. Berg was then assigned to Aberdeen Proving Ground in Automotive Division of Ordnance Research and Development Center, and engaged in field performance testing of all types of military automotive equipment. In June 1945 he was assigned to Field Service, Maintenance Division, Fuels & Lubricants Branch, of the Office, Chief of Ordnance, Washington, D. C.**

**Capt. A. G. Alen reported for active duty as a 1st Lieutenant 16 October 1942 and was assigned to the Instructions Section, Fuels and Lubricants Branch, Maintenance Division, Field Service, Office, Chief of Ordnance.**

**Since July 1943, Capt. Alen has been chief of the Instructions Section, the function of which is to prepare or approve all instructions concerning fuels, lubricants, and cleaning and preserving materials prescribed for Ordnance Materiel. He also serves as technical advisor during the preparation of training films and other material used for training purposes.**

**After leaving the University of Southern California in 1923, Capt. Alen joined the sales department of the Standard Oil Co. of California. He resigned in 1927 and started a chain of automotive service centers in Beverly Hills, Calif. In 1929 he joined the advertising department of the Richfield Oil Corp. of California. In 1935 he became Sales Promotion Manager of the Central Division and in 1937 returned to the home office as assistant merchandising manager, the position he held prior to reporting for active duty.**

of the charts are now standardized throughout the Army Service Forces. With the adoption by other services, additional assistance became necessary and another company, Service Analysts, Inc., now assists in this work.

Shortly after Pearl Harbor, with the activities of the Fuels and Lubricants Branch (then Section) rapidly expanding, Capt. G. H. Schoenbaum was transferred to Headquarters, Services of Supply (now Army Service Forces) to coordinate fuels and lubricants problems on a broader scale. He was replaced as Chief by Capt. Val Gates (now Lt. Col. Gates) who was, in turn, replaced by Capt. J. A. Richardson, III (now Lt. Col. Richardson) when the former left for an overseas assignment. Both of these officers came into the Ordnance Department as Reserve Officers from the Shell Oil Co. Inc.

## Begin Use of Symbols

Under Capt. Richardson's direction, the Fuels and Lubricants Branch increased its activities with the increase in tempo with the war, reaching a peak in personnel in 1944, with 13 officers and 11 civilians. From 1942 until the present, numerous lubrication and fuel problems have been solved and considerable progress made. Among these was the starting by this branch of the use of symbols to save space and improve clarity in listing various lubricants on lubrication charts. The symbols on the charts were then repeated throughout instruction manuals and on fuels and lubricants containers. In this manner, the soldier can readily match symbols in selecting and applying fuels and lubricants in the field. This system has now been standardized throughout the Army and standardized symbols have been assigned to all fuels and lubricants used by the Army ground forces.

Just prior to the start of the war, it had been found that fuels and lubricants, particularly the latter, then available were with few exceptions unsatisfactory for use at temperatures below 0°F. Extensive work was carried on during the winters of 1942-43 and 1943-44, resulting in the development not only of adequate lubricating oils and greases, but

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## *Army Benefits from Industry Experience of These Petroleum Engineers*

**Capt. Morgan B. Lawton, on active duty with the Ordnance Department since June, 1942, reported for duty in the Fuels & Lubricants Branch, Maintenance Division, Field Service, after completing a two month training period at the Ordnance School, Aberdeen Proving Ground, Maryland. He has served in the capacity of assistant chief of the Surveillance and Instructions Sections and as chief of the Dispensing Equipment Section, Fuels & Lubricants Branch.**

**Prior to entering the armed forces, Capt. Lawton was employed by the Lincoln Engineering Co., St. Louis, Missouri, as an industrial sales engineer. His service with Lincoln dated from 1935, during which time he acted as industrial representative for the south-eastern states and as special industrial engineer for the eastern half of the United States. His mission involved the prescribing of various types of lubricating equipment and appliances, including centralized lubricating systems, for applying lubricants to all kinds of industrial machinery, as well as the dispensing of plastics and other materials from original containers.**

**Capt. Lawton was graduated from Lismore College, Waterford, Ireland in 1928, after which he came to the United States.**

**Capt. R. O. Slattery is a native of St. Louis, Missouri. He is a graduate of the Mechanical Engineering School of Washington University at St. Louis, Missouri, a member of the Society of Automotive Engineers and a registered engineer in the state of Missouri.**

**He is on military leave from the Shell Oil Co. after being in the oil industry since 1930. Prior to the time he was called to active duty, Capt. Slattery was assigned as lubrication engineer in St. Louis, Missouri. This assignment provided varied experience in the application of fuels and lubricants in industrial plants, mining, construction work, and in bus and truck operations.**

**On being called to active duty in August 1942, Capt. Slattery was assigned as Chief of the Instructions Section, Fuels and Lubricants Branch. In July 1943, he was transferred to Detroit and was subsequently assigned to duty as Chief Fuels and Lubricants Section, Maintenance Division, OCO-D.**

**He has served as an Ordnance representative on a number of SAE committees cooperating with the Ordnance Department on problems involving lubrication, rust prevention, and other factors affecting maintenance.**

also of improved materiel from a mechanical standpoint.

With the necessity for shipping Ordnance material to all parts of the globe not only to our fighting forces, but also to those of our Allies under Lease-Lend came the problem of protection against corrosion and mechanical damage during shipment. The Fuels and Lubricants Branch early recognized this and upon its recommendation a group of boxing and packaging experts was set up in the Ordnance Department to provide assistance in formulating proper boxing and packaging procedures in conjunction with the necessary applications of proper rust preventive oils and compounds worked out by the Fuels and Lubricants Branch.

Coordinated work resulted in the formulation of the first complete and satisfactory packaging instructions provided to industry by the Army and eventually the principles of cleaning, preserving and packaging developed by this group were adopted not only by the rest of the Army, but also the Navy. During this work, the oil industry responded in every way possible in the provision of new preservative materials either for development or in the manufacture of those already developed.

In the hectic early days of the war when everything had to be done at once, there was rarely enough time to run tests and work out best uses of preservatives. It is testimonial to the knowledge of these petroleum officers that in the majority of instances, proper selection of materials was made with little loss of time in reaching necessary decisions.

One of the largest stumbling blocks to standardization of lubrication procedures in the Army was the multiplicity of lubricating fittings and lubricating guns in existence on Army equipment. Before much standardization of lubricating guns could be accomplished, it was necessary to develop a standard lubrication fitting which would replace the various hydraulic, button head, pin type and

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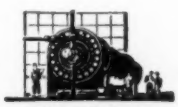
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*Lubrication Experts Who Help Run Fuels and Lubes Branch for Ordnance Department*

**Capt. George S. Huntington, on active duty with the Ordnance Department since July 1942, reported for duty with this branch after completion of a four months training period at the Ordnance School, Aberdeen Proving Ground, Maryland. He has served in the capacity of assistant chief both of the Technical and Surveillance Sections.**

**Prior to entry into the service, Captain Huntington was employed by The Texas Co. His service with this company, dating from August 1933, included assignments in the sales department as industrial salesman, lubrication engineer and sales engineer, and in the research laboratories of the refining department as mechanical engineer.**

**Capt. Huntington was graduated in 1932 from the Stevens Institute of Technology with the degree of Mechanical Engineer.**

**A. R. Taylor was assigned to the Instructions Section, Fuels & Lubricants Branch, Field Service, Maintenance Division, Office, Chief of Ordnance, in May 1943.**

**Under the general administrative supervision of Chief of Instructions Section, he reviews instructions in War Department lubrication orders and technical manuals covering small arms, artillery, sighting equipment and fire control instruments, initiating the processing of additional lubrication and preservation instructions when necessary.**

**Prior to his employment with the War Department, he spent 15 years with the Sinclair Refining Co. as an assistant to the chief lubrication engineer, his principal responsibility during this period being the preparation of articles, indexes and charts pertaining to the lubrication of automotive, industrial and road building, and construction equipment.**

other kinds of fitting then in use. The Fuels and Lubricants Branch was primarily responsible for this development and many thousands of dollars of taxpayers' money have been saved by this standardization.

The success of this program on Ordnance materiel eventually resulted in the Ordnance Department being made responsible for the standardization of lubricating fittings and equipment throughout the Army ground forces. This responsibility in the Ordnance Department, ASF is assigned to the Fuels and Lubricants Branch.

As previously pointed out, the Fuels and Lubricants Branch was also made responsible for selection and proper usage of additional fluids, whether or not of petroleum origin, and for cleaning materials of all kinds, oil filter elements and welding, soldering and brazing materials. A standardization and coordination job similar to that accomplished with fuels and lubricants has been necessary and is being carried out.

These additional duties have made it necessary for the oil men in the Branch to engage in intensive studies of these materials and their uses. Although this has represented much additional work on their part, the experience and additional training gained thereby will undoubtedly be useful to them and their companies when they return to the oil industry.

The gradual nearing of completion of the various standardization projects and the systematizing of the production of instructions during the past three years has made it possible even with reduced personnel to increase the amount of inspection and surveillance and to tie up many loose ends in the way of obsolete equipment and supplies. Extensive ground work must now be laid for the proper preservation of all kinds of materiel for long time storage, and during the past year supervision of preservation and packaging to the Pacific has been a major task.

Since various petroleum products, particularly waxes, are necessary in the preservation of materiel against the severe rusting and mildewing which occurs in the Pacific areas, the Fuels and Lubricants Branch also has responsibility for this work in Field Service of the Ordnance Department, ASF.

## Reflected All Over Globe

Since the preponderance of Army ground equipment using fuels and lubricants must be maintained and supplied with spare parts by Ordnance Field Service, the activities of this small group of former oil men in the Fuels and Lubricants Branch are reflected throughout the Army and wherever on the Globe our Army is in action.

Basic policies established concerning

petroleum products to be used to keep guns and vehicles doing their jobs with a minimum of wear determine in turn what products must be shipped overseas, stored and kept in supply dumps right behind the fighting troops. Keeping kinds and grades to a minimum and quality to a maximum must be coordinated with other using Services, Army-Navy Petroleum Board, Quartermaster who supplies the bulk of the petroleum products and the Petroleum Administration for War.

That these and other oil men in the Army have been accomplishing this mission is indicated by the general tenor of numerous reports by qualified observers both from Ordnance and other organizations, all to the effect that the quality of our fuels, lubricants and preservations is tops, they perform satisfactorily when used as prescribed, the enemy has no better materials nor more advanced methods of using them.

## Oil Men In Branch

In addition to Lt. Col. Landis and Maj. White, the Fuels and Lubricants Branch, in addition to clerks and stenographers, has following oil men in Washington:

Capt. Morgan B. Lawton, formerly with Lincoln Engineering Co. and Socony.

Capt. Arthur G. Alen, formerly with Richfield Oil Co.

Maj. William A. Howe, formerly with the Standard Oil Co. of New Jersey.

Capt. George S. Huntington, formerly with The Texas Co.

Capt. Edgar H. Berg, formerly with Standard Oil Co. of New Jersey.

Mr. A. R. Taylor, civilian Engineer, formerly with Sinclair Refining Co.

Mr. Wilbur G. Perriguey, consultant, employed by the Standard Oil Co. of New Jersey.

In Detroit working exclusively on the same problems in connection with automotive equipment are:

Capt. R. O. Slattery, formerly with Shell Oil Co. Inc.

Capt. Robert W. Carr, formerly with Colonial Beacon Oil Co.

## Hickok Employes To Receive Fourth of Company's Income

CLEVELAND—Between four and five hundred employes, from president to office boy, will receive one fourth of the income of the Hickok Oil Corp., Toledo, a recent report states.

Those who have been on the company's payroll continuously for five years, will participate in accordance with the terms of the will of Arthur S. Hickok, late president and founder of the company. The distribution is to etend over a period of 20 years, but does not cover lessees of bulk and service stations who operate them for their own profit.

Mr. Hickok's estate was in excess of $1,000,000, and real estate in excess of $500,000. It was stated that the bequest to employes will become effective within a year.

## *GI Gasoline Station in the Marianas*

**Cpl. Clyde E. Hughes, Pittsburgh, Pa. (left) and Pfc. V. Reale, Waterbury, Conn., service a Jeep at an Air Forces gasoline station on Tinian. Though short on streamlined construction, the station always has gasoline**

## Rubber Co. Official Predicts Tire Ration End Before '46

NPN News Bureau

CLEVELAND — John L. Collyer, Goodrich president, recently told an audience in Chatauqua, N. Y., that tire rationing for American motorists should end this year. However, he added, it might be the end of 1946 before motorists would be able to get chosen brand of tire at the exact time they might want it.

The outlook for synthetic and natural rubber, now that the Far Eastern rubber producing areas will be restored to their rightful owners, Mr. Collyer said, is that the rubber problem will be that of a world surplus of rubber.

"With our own huge synthetic rubber capacity, a small foreign synthetic capacity and a tremendous world production of natural rubber, we could have 2,800,000 tons to supply the expected 1,500,000 ton annual demand.

"Once natural rubber has been restored, America will have to choose between the natural and synthetic materials. Synthetic rubber can make a major contribution in limiting the extent to which prices for natural rubber increase. Today, however, synthetic rubber costs and prices are complicated by a problem of base material costs.

"The cost of synthetic rubber from grain alcohol is above 40 cents a pound, while that produced from petroleum is about 14 cents a pound, exclusive of amortization and depreciation costs."

Discoveries may be made which will whittle down or possibly even eliminate the quality advantage which natural rubber now holds for tire manufacture, he added.


## FREE TO SERVICEMEN

Any Serviceman who is interested in getting a job in the oil industry may run a "Position Wanted" advertisement in the classified advertising section of NATIONAL PETROLEUM NEWS.

This service is FREE to Servicemen until further notice.

Within space limitations, your advertisement will be run according to copy you send us. We suggest you describe in a few words the kind of job you want, your qualifications and the location you prefer.

Be sure to give us your serial number, name and permanent address for answers.

Send your copy for the advertisement to:

Classified Advertising Dept.,
NATIONAL PETROLEUM NEWS,
1213 West 3rd Street,
Cleveland 13, Ohio.

# BIG NEWS IN THE OIL BUSINESS!

## New Type Wooden Box Cuts Shipping Container Cost To Less Than 3c Per Round Trip For 24 Quart Cans

### NO SPECIAL EQUIPMENT NEEDED

Patented "toggle type" latch holds lid securely; opens easily without special tools. No nailing—no special equipment needed in your plant. The rugged, extra strength of Sullivan Boxes is the direct result of extensive experience in building millions of ammunition boxes for Uncle Sam.

In the very first test made by a major oil company this Sullivan-built box made 34 round trips between refinery and dealer, using the same lid throughout.

In quantity the oil box illustrated here can be bought for as little as $1.01 each. At that price, 34 round trips means a shipping container cost of less than 3¢ for every 24 quart cans you ship. Compare that with the cost of any container you might now be using.

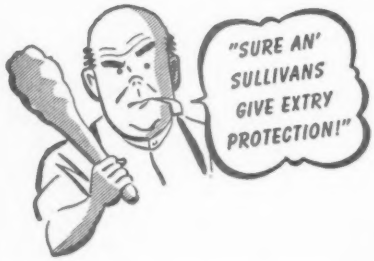
### PRICE SCHEDULE

The following prices are for boxes as illustrated, holding 24 quart cans, complete with self-locking toggle hardware and reusable lid; printed in one color.

| | | | |
|---|---|---|---|
| 5,000 . . | $1.18 each | 25,000 . . | $1.08 each |
| 10,000 . . | 1.13 each | 100,000 . . | 1.01 each |

(Prices subject to change without notice)

### IMMEDIATE DELIVERY




. . . No waiting. We can accept orders for immediate production. 40 ft. box car holds 2,700 boxes; 50 ft. car 4,475 boxes. Box weighs 10½ lbs. empty.

SULLIVAN BOX FACTORY

Write, Wire or Phone

**SULLIVAN BOX FACTORY**

Sullivan, Illinois • Phone L.D. 7

**By Herbert Taylor**
**NPN Staff Writer**

CLEVELAND — Return of credit cards on Sept. 15 by cancellation of Directive 62, which banned them during the war, will find most, if not all, companies geared up to resume where they left off when the ban went into effect.

That the industry had decided to use this form of credit again is evidenced by promotion activities of the major oil companies in the past few months in keeping in touch with former credit card holders and bringing their lists up to date.

### Sent Out Letters

Typical of this promotion was a letter sent out last May to former card holders all over the country. The letter, accompanying an application card, said in part:

"The day may not be too distant when present governmental restrictions on the use of credit cards may be lifted. Should this occur, you may wish to possess a (company name) credit identification card. So we'll appreciate it if you'll check the enclosed post card and thereby let us know if you will again desire to use a (company name) credit identification card when Uncle Sam says 'yes.' "

Now that Uncle Sam has said "yes", there is much evidence, based on discussions with oil company executives—both sales and credit men, that many of the former abuses of the credit card system will be corrected.

Here is one proposal made by a general credit manager of a major oil company, after many surveys, and after nationwide contact with the management of other companies on the subject:

**Credit cards will be back with cancellation of Directive 62 effective Sept. 15**

**No oil company would deny there has been some abuse of this phase of oil marketing. Suggestions as to how some of these abuses may be eliminated are given here by the general credit manager of one of the larger oil companies, and the vice president and manager of a leading major company**

**Articles on this subject appeared in the following issues of NPN: Dec. 20, 1944 p. 38; Jan. 3, 1945, p. 19; Jan. 17, 1945, p. 38; Jan. 24, 1945, p. 14; Feb. 7, 1945, p. 18; Feb. 21, 1945, p. 18; Mar. 14, 1945, p. 20; Mar. 28, 1945, p. 28**

### Suggested Uniform Plan

It is proposed first that oil companies adopt two forms of credit cards—annual and quarterly.

The annual credit cards would be issued only to preferred credit risks. They would be good throughout the territory in which the company operates.

The quarterly cards would be issued to other classes of credit risks.

No credit card would be reissued to any account more than 30 days delinquent.

Interchange of credit cards between companies would be limited to annual cards only—and only between affiliated companies.

The annual and quarterly credit cards would be good for the purchase of petroleum products and services.

The exception to the above proposal would be that holders of annual or quarterly cards would be permitted to purchase tires, tubes, batteries and accessories at their regular home dealer only. (This, the credit executives explain, would eliminate the tremendous overall losses by companies where poor risks or those who have stolen the cards, can drive from coast to coast and buy thousands of dollars worth of merchandise before the sales tickets are processed.)

It is proposed that on a limited credit basis, customers be furnished with a local card good only at a specific dealer station. In some cases this could be accomplished by the supplying company furnishing a dealer a letter or list of accounts the company will carry.

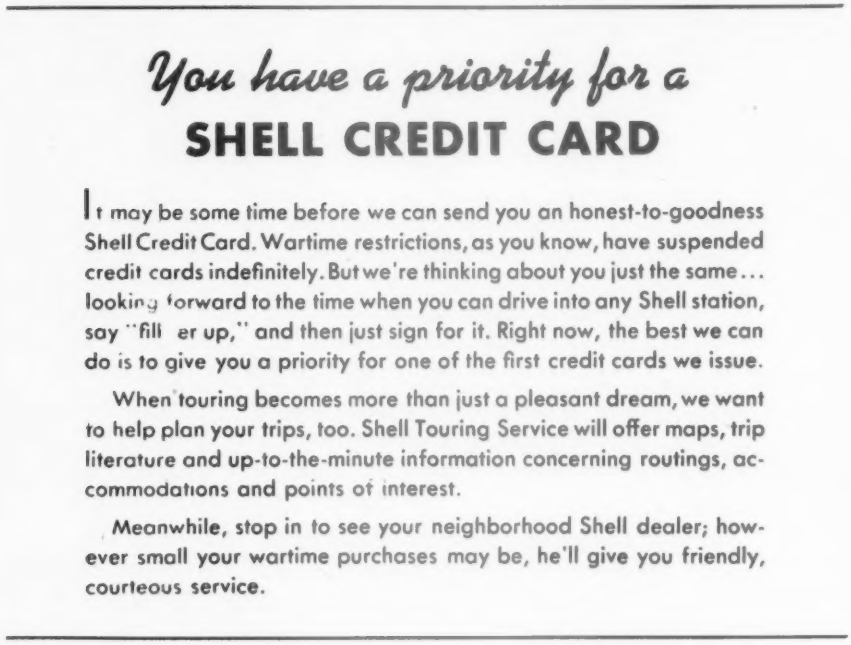
It is pointed out that this method will prevent a small credit purchaser from buying at a half a dozen or more locations when he just as easily can buy at one, and thus reduce clerical expense.

It is proposed to liberalize this plan to include local purchases of tires, tubes, batteries and accessories.

### Service Charge

In this credit manager's investigation of practices of companies, it was found that some companies have successfully made a service charge against dealers, jobbers and distributors for the handling of credit cards to compensate for the supplier's expense in handling credit card business.

He says that such a plan would be log-


You have a priority for a
SHELL CREDIT CARD
It may be some time before we can send you an honest-to-goodness Shell Credit Card. Wartime restrictions, as you know, have suspended credit cards indefinitely. But we're thinking about you just the same... looking forward to the time when you can drive into any Shell station, say "fill er up," and then just sign for it. Right now, the best we can do is to give you a priority for one of the first credit cards we issue.
When touring becomes more than just a pleasant dream, we want to help plan your trips, too. Shell Touring Service will offer maps, trip literature and up-to-the-minute information concerning routings, accommodations and points of interest.
Meanwhile, stop in to see your neighborhood Shell dealer; however small your wartime purchases may be, he'll give you friendly, courteous service.

**Typical of credit card promotion in anticipation of the lifting of the ban is the above broadside sent former holders by Shell. Some of the companies used letters and other form of direct mail. When the ban officially goes off Sept. 15, most former credit card customers will again have retail charge privileges**

ical, since the dealer, jobber or distributor is a separate business concern, and that the supplier acts in the capacity of a financing agency. The supplier, he goes on to say, makes profits from original bulk sales to the dealer, jobber or distributor.

This credit executive says that according to a survey, the supplier's profit is reduced nearly one cent a gallon on all sales taken over by the supplier from the dealer, jobber or distributor.

With this in mind, he proposes this financing plan:

(a) A financing charge of not less than 1% (already in use by at least two companies before credit cards were banned) be made by the supplier against the dealer, jobber or distributor. It is pointed out that this is a very fair and reasonable charge, since the survey showed that credit card business costs between four and five per cent.

(b) Or, if the customer desires a credit card for an occasional emergency use only, and if his purchases on credit are low, say under $10 per month, or average less than $1 per ticket, that he pay a service charge of not less than five cents per ticket, or a minimum of 25c per month, to be added to his monthly statement.

The thinking of a sales minded vice president of a major oil company on the subject suggests that in the return of credit cards there be a careful control over their issuance. Here is his idea on the subject:

"Now that the credit card is about to be restored to petroleum purchasers for use at the industry's retail outlets, a good time is afforded to take a look at that device, both as an instrument for building up business and as a service to the consumer.

"Those in close touch with the industry during the emergency are impressed with the urgent need on the part of certain customers for the extension of credit privileges. Indeed, Directive 62 implied that when it made an exception in the case of government purchases and deliveries into commercial vehicles. Violations of this directive during the emergency in the case of hotel garages and certain service stations, betrayed a pressure from the consumer. Credit service is a convenience that the American purchaser in every branch of retailing expects and will get in one form or another.

"The opposition to credit cards grows out of its cost, and we believe that this cost grows out of an over-extension of this service to those not economically entitled to it. The remedy, therefore, would seem to be a careful control over the issuance of cards, limiting it to those purchasers whose volume would entitle them to this service, and the constant elimination of those whose experience does not justify a further extension of this privilege."

## Acquire Idaho Property

*Special to NPN*

LOS ANGELES—Purchase of all the petroleum distribution facilities and properties of John A. Baisch, Jr. of Twin Falls, Idaho, was announced by the General Petroleum Corp.

## British Given More Motor Fuel

*Special to NPN*

LONDON—The Ministry of Fuel and Power here has announced that effective Sept. 1 British motorists will have new and better basic gasoline allocations.

The average owner of a 10 hp automobile will be allowed six British imperial gallons of motor fuel a month, or approximately a one-fourth increase over the present amount. Other comparable quantities are: 1 hp to 9 hp, 5 gals. instead of 4 gals.; 14 hp to 19 hp, 8 gals. instead of 6 gals. and 20 hp and over, 8-1/3 gals. instead of 7 gals.

## A.G.A. Course Announced

NPN News Bureau

NEW YORK—"Fundamentals of the Gas Industry," a new training course which the American Gas Association will begin early in September, will be available to all employes of gas companies.

The course will be presented in three one-hour classes or six half-hour classes. It will utilize narration, sound slidefilms and text, and will be presented by gas company department supervisors.


### NPN CHECK SHEETS

It's a good thing to remind yourself every once in a while that:

INCOME *minus* EXPENSES *equals* PROFIT

NPN Check Sheets help you reduce your Expense—and so increase your Profit—by finding actual and potential "leaks".

Written by a practical, experienced oil operating man, and published in three successive issues of NPN beginning with the issue of July 4, NPN Check Sheets have proved their effectiveness in actual use.

Reprints are now available of the three NPN Check Sheets, as follows: "BULK PLANTS AND WAREHOUSES", "TANK TRUCKS AND TRANSPORTS", and "SERVICE STATIONS".

Each NPN Check Sheet covers in detail the things that need to be inspected to insure efficient, economical and uninterrupted operation; is arranged for convenient but thorough checking; has space for necessary notes; and a quick, easy way to give the inspected property a rating.

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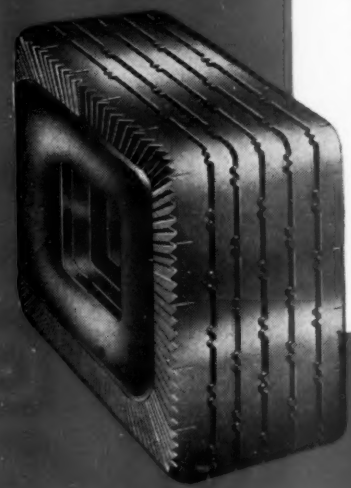
# THE BACKGROUND THAT MOVES FORWARD

A SQUARE DEAL IN RUBBER

It is fitting that the first letters of Pharis and Progress should be the same. For the two words are inseparably linked. The Pharis Square Deal in Rubber changes with the times, constantly adjusts itself to new conditions. But always it has the needs of Pharis dealers in clear focus. It is a policy which repeatedly proves that "Pharis takes care of its own" under all circumstances.

THE PHARIS TIRE & RUBBER CO.
NEWARK, OHIO



PLANT No. 2

The PHARIS TIRE

## Mid-September Hearing Is Set On Michigan Spacing Rules

*Special to NPN*

LANSING, Mich.—Emergency Order No. 12 issued recently by P. J. Hofmaster, supervisor of wells for the Michigan Conservation Dept., has the effect of continuing through Sept. 21, the 2 and 40 acre well spacing patterns established for Michigan fields by PAW under PAO 11 and supplements which have been cancelled as of Sept. 1.

Public hearing will be held Sept. 14 to determine if the state's emergency order will be made permanent. Some operators have suggested that spacing be retained in certain fields, while others have asked for exceptions.

## Wildcatters Active In Ill. Basin Following New Wells

*Special to NPN*

WAYNE CITY, Ill.—Two commercial pay wells from the Aux Vases sand, one in Wayne County and the other in Hamilton County, have stimulated wildcatters active throughout the Illinois basin.

A pump test at the Texas Co's. No. 1 A. Bowyer located three miles northwest of Wayne City adjacent to Keenes village showed 101 b/d but with 14 barrels of water from the Aux Vases at 2974-81. The well has not been shot.

Drillers believe the area will show better production with the next well, and that the present well may show better because of its varying sand condition a little higher on structure.

Carter Oil Company's deeper hole on the Provident Mutual Life Insurance Co's. land in Hamilton County is making 126 b/d from the streaked Aux Vases sand found at 3286-3318. Total depth of the hole is 3327.

It is located two miles northeast of the Bungay Oil Pool which also produces from the Aux Vases.

Production from the Aux Vases sandstone in White County at 3020 feet in the Brownsburg Pool is also reported.

Operations throughout the Indiana and Illinois leased areas are steadily expanding.

# Texas Commission Locks Horns With PAW, Cuts State's Crude Output 400,000 B/D

### Affirms 'Sovereign Rights' by Putting Nearly All Fields on 20-Day Basis; Shrinking Market Draws Fire on PAW and Majors

**By Brown Booth**
**NPN Special Correspondent**

AUSTIN, Tex.—The Texas Railroad Commission, for the first time since the war started, has taken PAW by the horns and thrown overboard its recommendations for September production.

In a drastic curtailment of the state's oil production, the Commission slashed allowable production nearly 400,000 barrels daily, almost twice the amount suggested by PAW in its revised estimate sent to Austin shortly after the Japs surrendered.

"By this aggressive action, Texas is again exercising her sovereign rights as a state during peacetime to control the production of oil within her own borders," Commissioner Ernest O. Thompson commented.

The Commission's September order followed the first real state-wide proration hearing since the war, and it was at this hearing that it became apparent that Texas oil faced a rapidly diminishing market. Oil company representatives, paced by the 20% horizontal slash in nominations by Humble Oil & Refining Co., told the Commission of their lessening needs and counseled heavy cuts to prevent a glut of storage.

The Commission's reduction of 395,588 b/d in the state's daily production compared with PAW's request for a cut totaling 212,000 b/d. Chairman Olin Culberson explained that the basic daily allowable of crude will remain the same —1,973,813 barrels—and the cut will be made by reducing the number of production days.

### Five-Day Reduction General

Most of the state's fields will have five fewer producing days in September than in August. East Texas was cut from 25 to 20 days.

Chairman Culberson explained the mechanics of the cut thus: "According to instructions given by the Commission, all fields producing above the maximum efficiency rate have been reduced to the M.E.R. first.

"East Texas was then given 20 producing days, which brought the allowable down from 384,810 to 318,452 barrels. All fields in the state were then placed on a 20-producing-day basis with the exception of the Panhandle which was exempt from shutdown days due to the fact that the last report showed that the field produced only 87,667 barrels per day. Therefore it was our opinion that if the field had been placed on shutdown days some of the wells and leases which are able to make their allowables would have been penalized. Furthermore, all the asphalt type crudes, such as Cayuga, Talco, Sulphur Bluff, and Hawkins were put in a class to themselves, and Sulphur Bluff, Talco and Cayuga are still exempt and Hawkins was placed to the nominations.

"Since September is a 30-day month, in order to put all fields on a 20-producing-day basis for September, the M.E.R. fields which were first reduced to the M.E.R. were then reduced further by five days to those fields which were on the exempt list in order to allow them to produce oil for the war effort. Those fields which were not on the exempt list, due to water conditions and other physical conditions, were also taken off the exempt list and five-day shutdowns placed on them."

Culberson explained that no change was made in any field now receiving a new pool allowable nor was there any change made on any well receiving an allowable due to its discovery rights. (In an effort to encourage wildcats, new wells are exempt from shutdown days.)

### State-Wide Cut Is 16.7%

The slash will reduce the state's output 16.7 per cent, the Commission figured.

Following is the table which shows how the state will produce by districts in September:

| District | Percent Reduction | Net Allowable |
|---|---|---|
| 1 | 3.83 | 24.812 |
| 2 | 27.25 | 125 979 |
| 3 | 19 22 | 450 003 |
| 4 | 17.55 | 196 445 |
| 5 | 16.42 | 38.021 |
| 6 (outside) | 11.18 | 92,992 |
| 6 (East Texas) | 17.24 | 318 452 |
| 7-B | 9.73 | 31 063 |
| 7-C | 10.86 | 24 248 |
| 8 | 14.49 | 445.857 |
| 9 | 13.44 | 124 900 |
| 10 | 0 | 101,041 |
| | Total | 1.973.813 |
| | Present | 2.369,401 |
| | Decrease | 395,588 |

These figures are allowables without figuring in underproduction, which, at last accounting, amounted to about 152,000 b/d. To be added to the state-wide production figure are the condensates and natural gasolines, which come to about 165,000 b/d.

The Commission set its next state-wide hearing, when it will take up October nominations, for Sept. 14. This will give the Commission a chance to amend the present September order if developments show that the drastic cut works hardship any place, Mr. Culberson explained. Since the operators can produce their wells any 20 days during the month they care to, they will still not have used up their production days by the time the Commission meets

# 5 WAY PROTECTION

## WITH WESTINGHOUSE OIL-IMMERSED CONTROL

For applications in refineries where hazardous conditions and corrosive gases are present, you can't beat Westinghouse oil-immersed controls. They're built in sizes to cover the entire range of motor circuit voltages, and in various combinations of motor starting switches with or without disconnect switches.

These controls are part of a famous family—a complete line of Westinghouse electrical equipment for the petroleum industry. They'll give you safe, dependable, economical service—they're the result of *actual petroleum experience—years of it*. For complete information and expert help on your electrical problems, call your nearest Westinghouse representative. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-94682

## AGAINST

1. **CORROSION**
   —Because all mechanisms are oil-immersed.
2. **HAZARDOUS ATMOSPHERES**
   —Because the complete oil-submergence of arcing parts and connections shuts them out.
3. **MOTOR OVERLOADS**
   —Because thermal induction relays give positive protection.
4. **SHORT CIRCUITS**
   —Because "De-ion" Nofuze breakers isolate all faults.
5. **EXPOSED LIVE PARTS**
   —Because breaker is interlocked to prevent energizing controller parts, except when the protective oil tank is in operating position.

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

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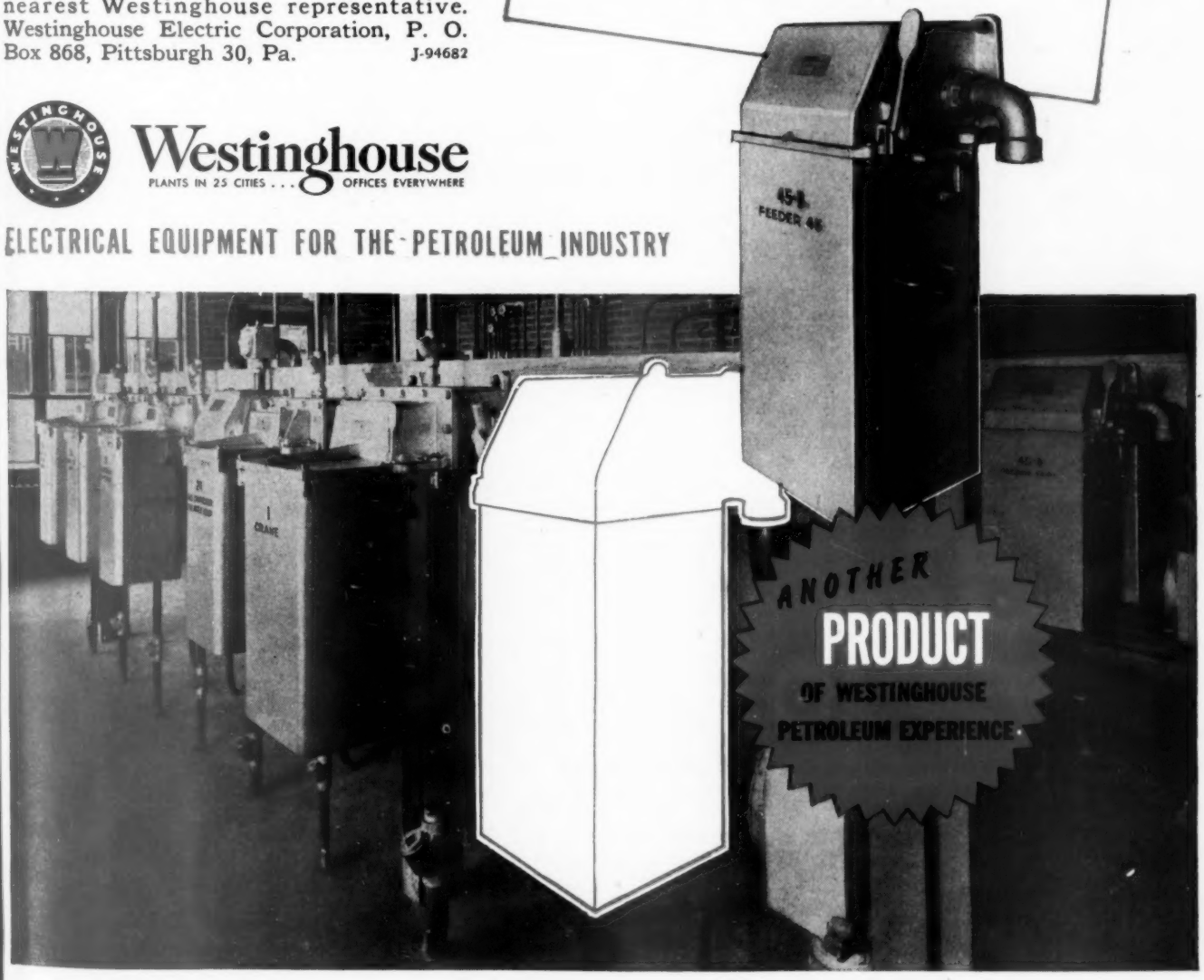


again, and their basic daily allowables are unchanged from August.

In making the new order, the Commission largely ignored purchasers' nominations which came in at the hearing. Total nominations were 2,252,528 b/d, compared to the 2,405,693 barrels the purchasers asked in the original hearing before Japan surrendered, but nearly 280,000 more barrels daily than the Commission granted. The revised nominations for East Texas were 419,000 barrels daily, or 100,000 more than the Commission granted.

It was evident at the hearing that the purchasers were still confused as to just what demand would be for the coming 30 days. Some of the nominations were presented in longhand after the hearing started.

Nelson Jones, representing Humble, which is the state's biggest purchaser, startled the session and indicated how the wind was blowing by announcing his company would take 128,649 b/d less than in August. He explained that the cut was arrived at by first separating the fields into sour and sweet crudes. After reducing the fields that had been producing in excess of their M.E.R., the demand for sweet and sour crudes was figured individually. Then the horizontal 20% cut was applied to all fields in the state, with the exception of the Panhandle.

"It is impossible to arrive at an exact figure of demand, but we have done the best possible," he explained. Humble's was one of the nominations that came in so late that the Commission was unable to announce at the session what the total nominations were.

Resentment against the PAW request that Big Inch be filled with set proportions of West Texas and East Texas crudes flared at the session, even though PAW's figures cut the run of the big carrier 100,000 b/d in September.

H. P. Nichols of the East Texas Oil Assn. declared: "The independent should not be called upon to draw on his reserves at 75% less than replacement value to fill the Big Inch." C. R. Starnes of Longview urged that East Texas be placed on a 20-day producing schedule "regardless of the needs of refineries at the far end of Big Inch to maintain their inventories."

"The war is over," said Maston Nixon of Corpus Christi (Southern Minerals). "Big Inch is an emergency line and it is apparent that PAW intends to shut down the line as soon as tankers are available. Every barrel of oil going through the line in September is not for war needs but for sale to purchasers on the Eastern seaboard. Whether this oil is East, West or South Texas crude is immaterial; they recommend what they would like to have.

**"Cut Hell Out of Texas"**

"I think East Texas has been imposed upon (by excessive demands) and I personally think we should cut hell out of Texas in order to keep the position of producers strong so we can get some relief on this price problem."

E. L. Wilson, East Texas independent producer, told the Commission that he had wells in the East Texas field that were being damaged by overproduction, and that he had just been informed that his wells that are producing normally in West Central Texas now had no market. He remarked that this seemed a peculiar situation to him.

The smouldering differences between the independents and major companies also drew sparks.

D. Harold Byrd of Dallas, president of the Texas Independent Petroleum Assn., got up and voiced his demand that all independents turn the valves on their wells and shut them off completely until someone gave in with a price increase.

Jim Young of Corpus Christi asserted that the low price of oil was caused by OPA taking the earning figures of the over-all operations of major companies and deducing from these figures that no price raise on crude was necessary. This worked a hardship on the independent who had no transmission and refinery profits to fall back on, he said.

**Says Majors Might Help**

"I wonder if it would be possible for the major companies for one time to go in and help on the price of crude?" he asked. "They should put their crude departments on their own feet and show what the earnings here are."

When the question was repeated to Nelson Jones of Humble by Col. Byrd, Jones replied tartly: "The position of Humble on the price increase is already a matter of record."

Chairman Culberson counseled caution about flying too much in the face of PAW "although nothing would please me so much as to see some of this usurped power taken off.

"But, PAW still lives—it never has been abolished by executive decree—and I wonder about the advisability of taking so drastic a step. We still are living in a nation of laws, not men."

Chairman Culberson also counseled against creating too much of a scarcity of Texas oil on the world market. Storage is down to an all-time low, he said, and there are 700 tankers that will soon be available. If Texas crudes become dear, it would be sound business practice for these refiners to fill this storage with cheap South American crudes, the oil men were told.

Col. Byrd said that if this came to pass the companies using the cheap foreign oil could be boycotted, but Culber-

## Sums Up Reasons for Clamp on Texas Oil

*Special to NPN*

AUSTIN, Tex.—When the Texas Railroad Commission cut the state's September production sharply in defiance of PAW Commissioner Ernest O. Thompson gave his reasons for doing so in a statement, part of which follows:

"By cutting oil production drastically for the month of September, the Texas Railroad Commission has tried to be realistic in facing the facts as we have found them to be. During the war period we have increased Texas oil production to an unprecedented high of 2,200,000 b/d. On the day of Pearl Harbor we were producing in Texas 1,400,000 b/d.

"Thus it can be seen that we have increased Texas oil output by 800,000 b/d. Certainly, come peace, we could not expect the market to consume any more oil just now than we were using before Pearl Harbor. Military needs will drop sharply. The consumption of the Army is about one and one-half gallons of gasoline per soldier per day. With 5,000,000 soldiers and 2,000,000 sailors being released from duty the Armed Forces will need 1,000,000 gallons less gasoline per day. Besides this, the armed forces have large stocks of petroleum products on hand.

"There are about 4,000,000 fewer automobiles in private use than were in use on Pearl Harbor day. This means a reduced domestic demand of about 175,000 barrels of oil per day from this factor.

"All these considerations make us come to the conclusion that to fail to reduce our oil production now would show a lack of courage to face the facts as they appear to us on the ground. If we did not cut production now, we would shortly find ourselves drowned in a deluge of unwanted crude.

"A good example of what I am talking about is found in West Texas at Abilene. The Onyx Refining Co. uses in its own refinery about 2200 barrels of oil per day when running at capacity. They have been and are now buying 7200 barrels of oil per day, selling 5000 barrels a day to Humble Oil & Refining Co. Humble was in turn selling that oil to an Eastern customer. The order has been cancelled and of course the local refinery can use only the 2200 barrels per day, leaving 5000 barrels per day without a market. Such example fully illustrates the situation that can only be met and remedied by a drastic cut in production."

#3 in a series of advertisements discussing postwar refining processes.

# NAPHTHA REFORMING FOR POSTWAR COMPETITIVE MARKETS

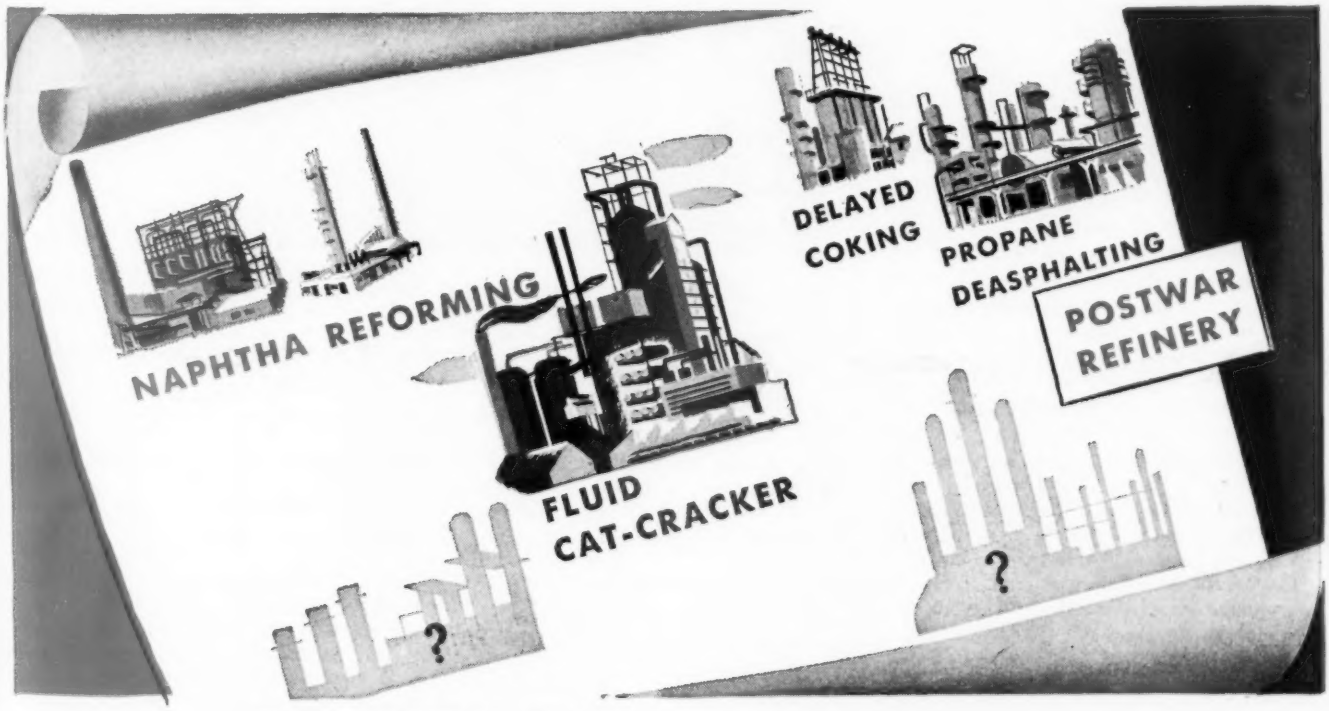
AMONG PETROLEUM marketing analysts the consensus is that postwar, house-brand gasolines will have at least an 80-octane (CFR-M) rating, while premium products will, of course, have even higher ratings.

With this trend in the making, refiners are now giving serious thought to postwar projects involving the stepping up of low grade naphthas. Three methods suit most requirements. (1) reversion, i.e., thermal reforming in combination with thermal polymerization. (2) thermal reforming with or without catalytic polymerization. (3) catalytic reforming or hydroforming.* The relative desirability of these methods is dependent, obviously, upon the octane level required, basic feeds, and cracking and reforming equipment currently available.

One of the surest ways for refining managements to safeguard capital investments and reach the *profitable* decision regarding choice of these alternate methods of reforming is to undertake a thorough economic analysis of overall operations. For years, M. W. Kellogg has emphasized this economic approach to engineering design and installations.

If naphtha remodernization is on your calendar . . . Kellogg engineers will be glad to help you put your project on the profits side of the ledger.

*Kellogg has designed and built *over 90 per cent* of the country's entire hydroforming capacity.




## THE M. W. KELLOGG COMPANY

***Engineers and Economists to the Petroleum Refining Industry***

KELLOGG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son told him this was outside the business of the Commission. "But," he said, "I do think it is a very short-sighted business policy to try to crowd the independent producer out. I think the integrated companies have failed to see the forest for the trees, and if this policy is pursued it will bring about the socialization of this vital industry, just as it has been brought about in England. God forbid that it ever happens here."

Chairman Culberson also gave notice to sour gas producers in the Panhandle that when the present agreement expires Oct. 1, the maximum sour gas production that will be allowed for carbon black manufacture will be returned to 750,000,000 cubic feet daily. Texas law sets this figure as the maximum production, but during the war the Commission, in response to government pressure, had been getting around it by gauging the gas at the channel instead of the wells.

## Oil Compact Group Marshals Forces for State's Rights Fight

*Special to NPN*

OKLAHOMA CITY, Okla. — Members of the executive committee and representatives of 12 oil and gas producing states met here over the week end to discuss testimony to be presented by the Interstate Oil Compact Commission before the Federal Power Commission at its investigation of the natural gas industry at Kansas City on Sept. 17.

Gov. Andrew F. Schoeppel, commission chairman, said that the Interstate Oil Compact Commission will stand on its policy of "state's rights" during the investigation. "That is our policy and that is what we will stress before the Federal Power Commission," Gov. Schoeppel said.

Gov. Schoeppel said that the commission would not discuss the matter of price or costs of natural gas. "Some interests would like to have us go into such matters, but they are without the scope of the commission," he added.

Neither will the commission dwell on "end use" of natural gas, although the gas industry feels that the FPC has gone too far in determining to what use the fuel may be put. It was pointed out that this phase probably will develop major argument when the industry presents its testimony to the FPC.

**Studies "Suggested" Statement**

In Saturday's meeting, Gov. Schoeppel's group made a study of a "suggested" statement covering three major topics: (1) History of the Compact Commission—its background and legislative history; (2) activities of the compact commission, and (3) accomplishments of the commission.

The two latter phases will set forth a general argument of the states to prove that they have, individually and collectively, enacted legislation, rules and regulations for proper development of fields, prevention of waste, and conservation of the products.

The official list of oil and gas state representatives attending the meeting include:

KANSAS, Gov. Schoeppel, Richard B. McIntyre of the Kansas corporation commission; TEXAS, J. C. Hunter, member and representative of Gov. Coke Stevenson; PENNSYLVANIA, Don P. Andrews, member and representative of Gov. Edward Martin; NEW MEXICO, Hiram Dow, member and representative of Gov. John Dempsey; LOUISIANA, Sam Jones, former governor and representative of Gov. James Davis.

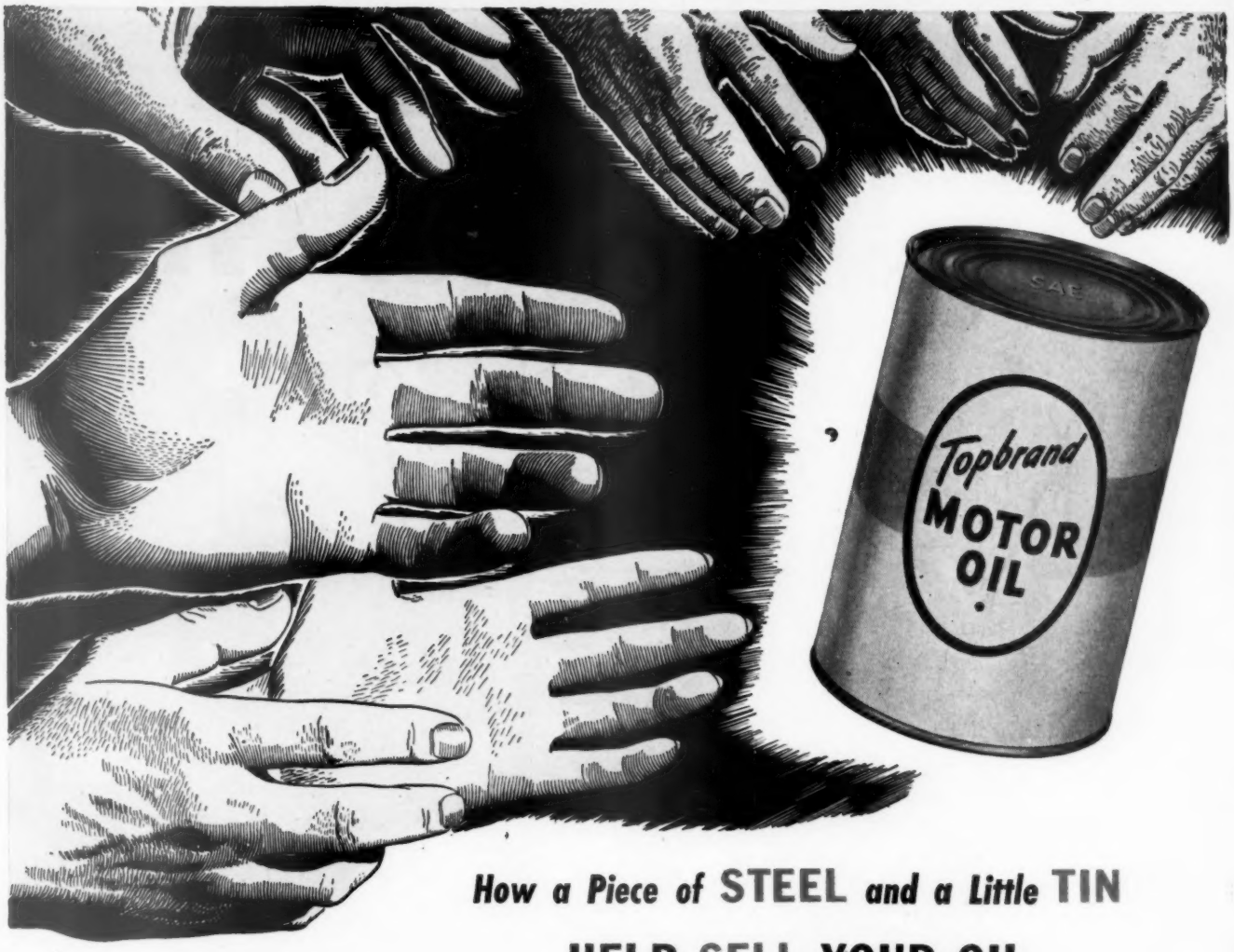
WEST VIRGINIA, H. J. Wagner, member and representative of Gov. Clarence Meadows; MONTANA, Casper P. Oien, representing Gov. Sam Ford; TENNESSEE, Paul Mathes, representing Gov. Jim McCord; ARKANSAS, E. M. Dutton, acting director, oil and gas commission; MISSISSIPPI, E. D. Kenna, vice-president, Mississippi-Alabama division, Mid-Continent Oil and Gas association.

Oklahoma is represented by Reford Bond, chairman of the corporation commission and representing Gov. Kerr and W. J. Holloway, former governor and compact attorney.

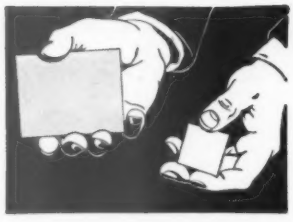
### Representatives of States Discuss FPC Hearing

**Among prominent representatives of 12 oil and gas producing states meeting in Oklahoma City last week end to discuss testimony to be presented by the Interstate Oil Compact commission before FPC on Sept. 17, were, above, left to right: Don T. Andrus, Bradford, Pa.; Merle Dutton, acting director of the Arkansas oil and gas commission; H. J. Wagner of Charleston, W. Va.; Gov. Andrew F. Schoeppel of Kansas**

**Early arrivals at the Interstate Oil Compact commission meeting in Oklahoma City, included, left to right: Casper T. Oien, representing Gov. Ford of Montana; Paul Mathes, head of the department of conservation of Tennessee, and Hiram M. Dow, representative of New Mexico, and a charter member of the compact group**




## How a Piece of STEEL and a Little TIN HELP SELL YOUR OIL



*It's more than 98% steel, less than 2% tin*

**How Steel-and-Tin Cans Help Your Oil**

1. Tamper-proof cans eliminate danger of substitution.
2. Cans assure full measure of clean, dependable oil.
3. Are fire-resistant.
4. Won't break.
5. Labels can be lithographed permanently on cans.

• Yes . . . steel-and-tin cans are sales tools as well as trouble-free containers.

You see, effective labels can be permanently lithographed right on the cans . . . with colorful, eye-catching designs which interest consumers. And cans help to build point-of-sale displays . . . tempting for your service station operators to feature . . . inviting for motorists to see. That's one reason why retailers find it so easy and profitable to sell motor oil packaged in cans.

That's not all! Packed in steel-and-tin containers . . . which are more than 98% steel, less than 2% tin . . . your motor oil pleases motorists because tamper-proof cans eliminate danger of substitution, assure full measure of clean, dependable oil. So, if you want containers that really help to sell, pack your motor oil in sturdy, trouble-free cans when Victory permits their unlimited use again.

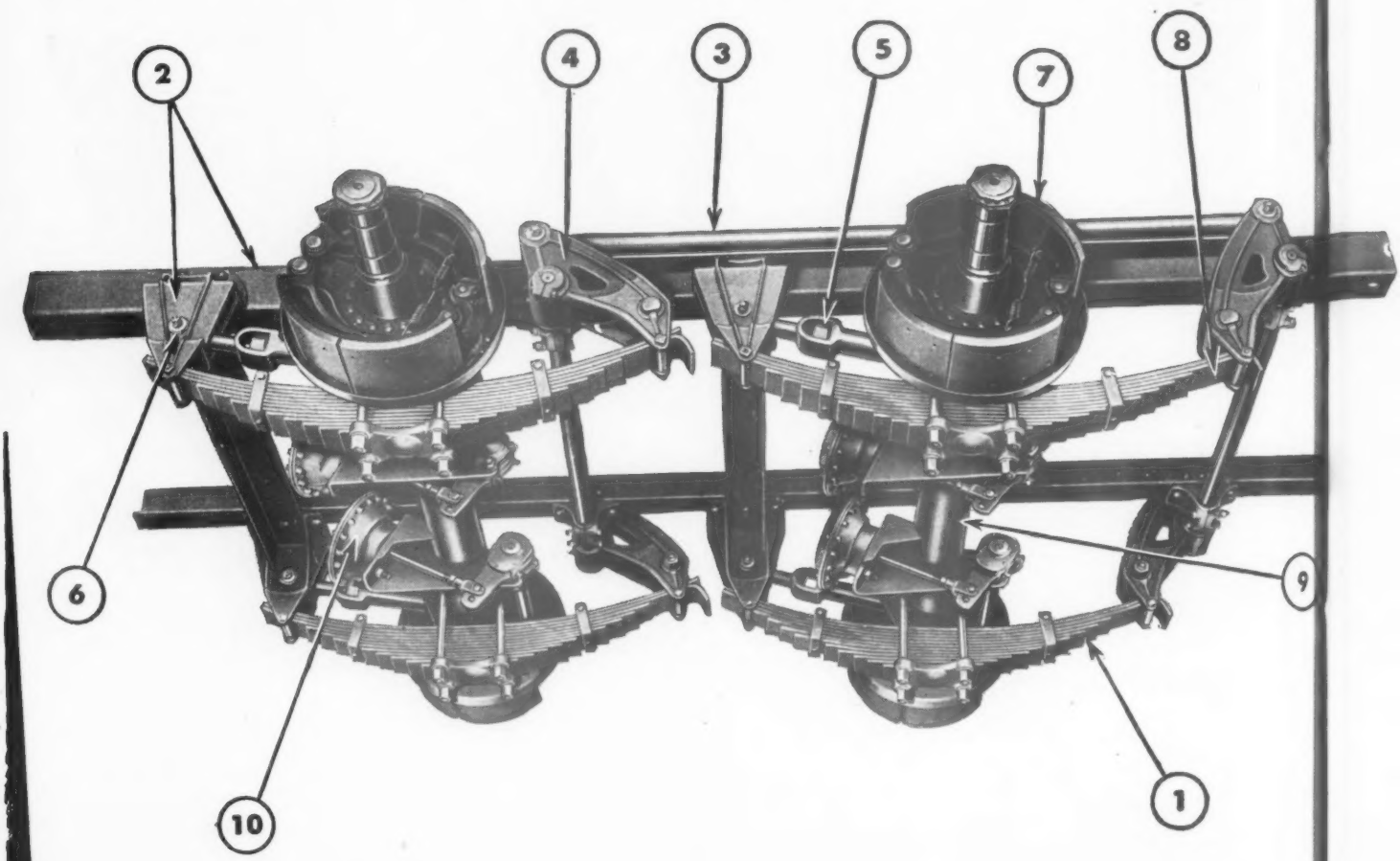
**WORDS TO THE WISE . . . ABOUT CANS**

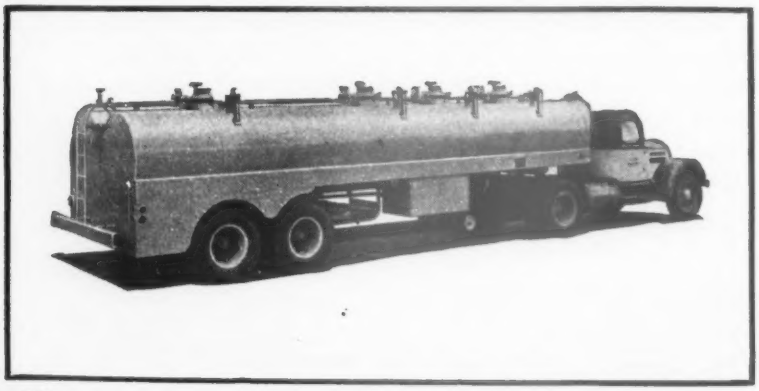
A nationwide advertising campaign . . . using full-page, full-color ads . . . is familiarizing shoppers all over America with the many practical advantages of *cans.* Six national magazines and the magazine sections of Sunday newspapers from the Atlantic to the Pacific carry more than 29,000,000 printed messages this month.

**CAN MANUFACTURERS' INSTITUTE, INC., NEW YORK**

NO OTHER CONTAINER PROTECTS LIKE THE CAN

# NOW! Butler Whips



Transport tank operators have discovered new economy, safer driving and trouble-free performance from the exclusive features of Butler Tandems—the first unit to lick many of the sources of excessive tire wear.

Eight point support of the frame gives double support for the loaded trailer. An equalizing assembly which prevents road-hopping and chattering. Radius rods that maintain wheel alignment and reduce horizontal movement of the axles. Better braking to maintain uniform wear. All these contribute to greater tire life, better truck performance and longer service life for your transport equipment.

One feature alone—Butler's spring-mounted brake torque and road shock equalizer mechanism saves 90% of the weight over equalizers mounted on the axle because every

# Tandem Troubles
# 10 WAYS

| | | |
|---|---|---|
| **1** | FOUR SPRINGS INSTEAD OF TWO support the load. | **RESULT**—easier ride, less strain on axle assembly. |
| **2** | EIGHT-POINT SUPPORT FOR FRAME over eight feet of frame length. | **RESULT**—less concentration, better distribution of load. |
| **3** | BETTER EQUALIZATION OF BRAKING TORQUE AND ROAD SHOCK by means of unique equalizers. | **RESULT**—road-hopping and chattering eliminated; smooth, equalized brake action. |
| **4** | EQUALIZING MECHANISM MOUNTED ON SPRING HANGER, instead of on axles. | **RESULT**—decrease in unsprung weight and reduction of pounding on tires, wheels and bearings. |
| | (100 lbs. of unsprung load equals 1000 lbs. of sprung load) | |
| **5** | PROPER ALIGNMENT OF AXLES MAINTAINED by adjustable swivel type radius rods. | **RESULT**—eliminates excessive tire wear due to misalignment of axles. |
| **6** | RADIUS RODS ATTACHED HORIZONTALLY to spring hanger instead of diagonally. | **RESULT**—minimum horizontal movement of axle during vertical movement. Decreases tire chafing. |
| **7** | 100% BRAKE SHOE CONTACT throughout life of brake lining with Timken "P" type brakes. | **RESULT**—decreases wear of tires due to unequal braking. |
| **8** | SLIP END TYPE SPRINGS, eliminating spring shackles. | **RESULT**—eliminates one of the most constant sources of trouble. |
| **9** | TIMKEN TUBULAR STEEL AXLES are light in weight yet extremely sturdy. | **RESULT**—additional thousands of miles of satisfactory service. |
| **10** | CHOICE OF BRAKE SYSTEMS. Butler Tandem axle units may be equipped with vacuum or air actuated systems. | **RESULT**—brakes to suit your preference and operating conditions of your territory. |

100 lbs. of unsprung weight is the equivalent of 1000 lbs. of sprung weight in increasing the pounding and shock on the tires, wheels and bearings.

In every test, Butler-Built Tandems have made a real contribution to the more economical and profitable operation of Butler Safety Transports.

Factories: Kansas City, Galesburg and Minneapolis
*Sales Offices in Principal Cities*

**BUTLER BUILT**
**SAFETY TRANSPORTS**

SEPTEMBER 5, 1945

Address all inquiries to: BUTLER MANUFACTURING COMPANY
7454 East 13th St., Kansas City 3, Mo., or
954 Sixth Ave. S. E., Minneapolis 14, Minn.

We are interested in Butler:
☐ With Tandem Axle Unit ☐ Safety Transport
☐ With Single Axle Unit

Size _____

Firm Name _____

By _____ Title _____

Address _____

City _____ Zone _____ State _____

## Tire Quotas for September Remain at August Levels

NPN News Bureau

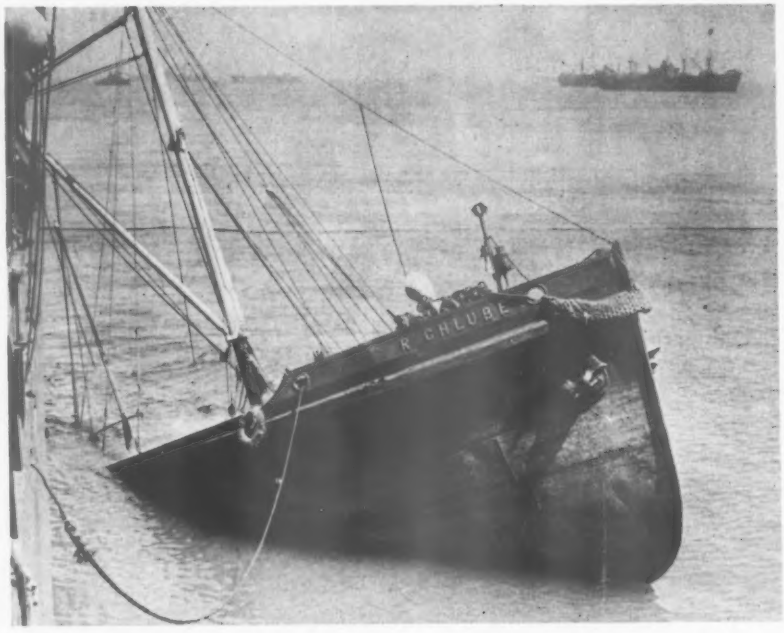
WASHINGTON—September tire quotas remain at August levels—2,500,000 for passenger cars, 3,?6,862 for small trucks, and 200,000 truck tires size 8.25 and larger—OPA announced today.

The new quotas are "the largest that could be provided for September," OPA said, but will fall far short of meeting flood of applications, particularly for passenger car tires, received since gasoline rationing ended Aug. 15.

The sole important change in WPB's September tire allocation to OPA for rationing is an increase of 20,000 in the truck and bus 10-ply tires in sizes 7.00-20 and 7.50-20, and a corresponding slash in remaining sizes in the smaller group. Nevertheless, OPA said the "most acute shortage" would be felt in large truck tires.

"Our rationing program," added Max McCullough, deputy administrator for rationing, "will provide tires for motorists as rapidly as production permits. Rationing of tires will end just as soon as enough tires are available to assure that our transportation system will not be crippled by a rush for tires that would strip dealers of supplies, leaving some drivers that perform most essential services without tires."

### *Small Tanker Sinks After Collision With Army Freighter*



**Small tanker M. S. Richlube is shown in San Francisco Bay after collision with Army freighter Morris Sheppard, which she was preparing to fuel. The tanker was swung beneath stern of Victory ship by a swift ebb tide. M. S. Richlube is owned by Richfield Oil Co. and was operated under lease by J. C. Freese Co.**

## Bell-Western Corp. Lets Pipeline Repair Contract

NPN News Bureau

TULSA — Bell-Western Corp. here, affiliated with the Bell Oil & Gas Co. interests, has contracted with the United Contracting Co. of Wichita Falls, Texas, to recondition the 4½ inch main line running from the Fargo and Odell fields to the Bell Oil & Gas Co. refinery at Grandfield, Okla.

The line will be completely raised, cleaned, coated, wrapped and will be equipped with cathodic protection and insulating flanges to prevent excess corrosion and erosion and electrolytic action.

The Bell line is the sole pipe line carrier from the Fargo and Odell fields of Wilbarger County, from which fields additional development is anticipated in the near future. The field has been producing from only one horizon and it is understood that application has been filed with the Railroad Commission of Texas to arrange dual completions from the other two producing horizons that have been developed in that area.

* * *

NPN News Bureau

TULSA—A new 35-mile pipeline and gathering system is being constructed by the Bell Oil & Gas interests from the Aylesworth area of Marshall County and the Mead Pool, in the same county, to the Ben Franklin refinery at Ardmore, Okla.

The Ben Franklin Refining Co., a subsidiary of Bell, has been gathering the oil from the two systems at a central station at Little City, from where it has been taken to the Ardmore plant by truck.

The pipeline will replace this method of transporting the oil, and the first stretch of the line will be built immediately from the producing fields to Madill, where the oil will be loaded in tank cars and transhipped to the Ardmore refinery.

It is estimated that the Madill line will be completed within two weeks and that 30 days after receipt of the additional pipe, the line will be completed on to the Ardmore plant.

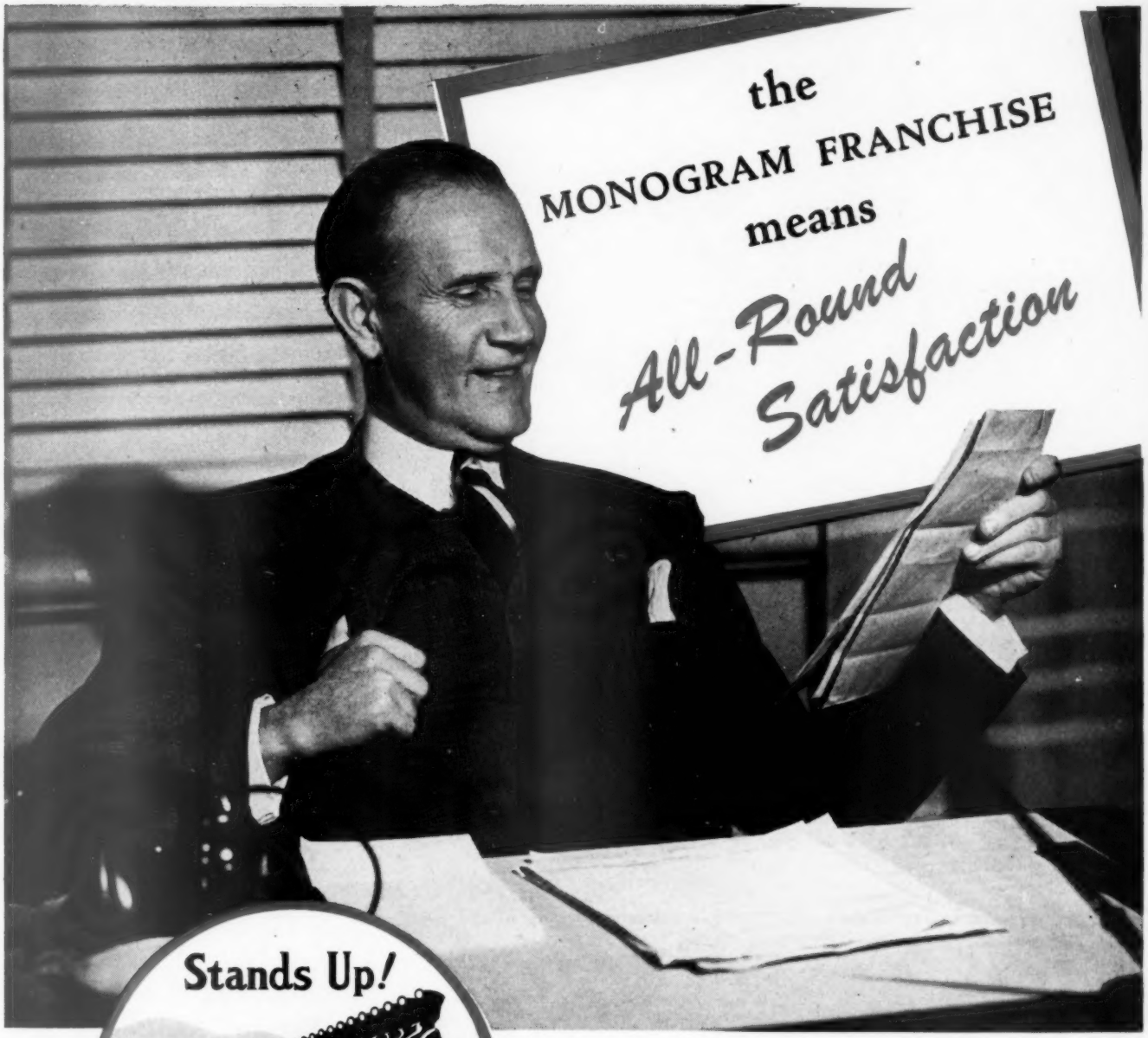
## Rail Hauls to East Coast Up 36,747 B/D

NPN News Bureau

WASHINGTON—Tank car loadings to PAW Dist. 1 averaged 303,935 b/d during the week ending August 25. Compared with the daily average of 267,188 bbls. for the previous week this shows a substantial increase.

Loadings, listed individually by reporting companies follow:

| | | | | | |
|---|---|---|---|---|---|
| Allied | 30 | Drake | 40 | Royal Petroleum | 5 |
| Amsco | 121 | Elk Refining | 11 | Shell | 559 |
| Anderson-Prichard | 3 | Freedom Oil | 5 | Sinclair | 53 |
| Arkansas Fuel | 4 | Gulf | 1145 | Socony-Vacuum | 669 |
| Ashland Refining | 147 | Hartol | 240 | S. O. California | 8 |
| Asiatic Petroleum | 24 | Home Oil | 9 | S. O. Indiana | 196 |
| Atlantic Refining | 527 | Jenney Mnfg. Co. | 14 | S. O. Kentucky | 97 |
| James B. Berry Sons | 20 | Lincoln | 2 | S. O. New Jersey | 2058 |
| Cantelou | 57 | National Refining | 3 | S. O. Ohio | 155 |
| Carbide & Carbon | 78 | Pan American | 845 | Sun | 230 |
| Chalmette | 18 | Petroleum Heat & Power | 33 | Talco | 21 |
| Cities Service Oil Co. (Pa.) | 261 | Phillips | 106 | Texaco | 942 |
| Cities Service Rfg. Corp. | 504 | Premier | 11 | Tide Water | 139 |
| Continental | 44 | Primrose | 8 | Tiona | 4 |
| Cosden | 57 | Pure | 40 | Triangle | 36 |
| Crown Petroleum | 26 | Republic | 6 | United | 28 |
| Daugherty | 24 | Richfield | 222 | | |




Stands Up!

MONOGRAM OIL

LOTS of progressive oil distributors, motor car dealers and service station operators have signed the Monogram franchise in recent months—in preparation for the vastly better business that lies ahead. And they're more than satisfied with what they signed because of what they get.

In a nut shell here it is. First, a brand-name as old as the automobile itself. Second, motor oils and lubricants refined from finest Pennsylvania crudes under the most modern techniques and, third, a sound, logical merchandising and advertising plan certain to make consistently good profits.

Couple these values to the consumer-loyalty Monogram has earned through the years and add Monogram's reputation for fair-dealing—you have the elements of a franchise that means "All-Round Satisfaction". Full details will be sent on request. Better write today!

**NEW YORK LUBRICATING OIL COMPANY**
**116 Broad Street • New York 4, N. Y.**

## Shell Chemical Co. to Build $2,000,000 Isoprene Plant

NPN News Bureau

LOS ANGELES—Shell Chemical Co. is to build a $2,000,000 plant for the recovery and purification of isoprene in Torrance, Cal., it is announced by J. Oostermeyer, executive vice president. It will be adjacent to the butadiene plant which Shell Chemical operates for the Office of Rubber Reserve of the Reconstruction Finance Corp. The new plant will be the largest single isoprene installation in the U. S.

Isoprene is a petroleum hydrocarbon used in the manufacture of a type of synthetic rubber particularly suitable for inner tubes and rubber specialties.

## Texaco Protests Unit Sale Of Federal Royalty Oil

NPN News Bureau

NEW YORK—Sale of federally-owned royalty oil as a unit was protested last week as a means of discriminating in favor of small refiners, in a comment by a representative of the producing department of The Texas Co.

This representative referred to the action in Washington on August 27 when five small refiners bid top prices for royalty oils from eight federal oil and gas leases in Colorado and Wyoming. At that time The Texas Co. protested the sale, as a unit, of royalty oil from the Wilson Creek, Iles and Rangely Fields in Colorado.

As the Texaco representative explained the situation, it is impossible to bid on royalty oil above the ceiling. That ceiling is $1.25 per bbl. That is the bid that Texaco uttered for this particular oil, which was desired in this case only from the Wilson Creek Field.

"Nobody can bid more than $1.25," the Texaco representative pointed out. "We were interested primarily in the Wilson Creek oil. Nevertheless, it was necessary for us to bid on the royalty oil as a unit from the Wilson Creek, Iles and Rangely Fields. This, I believe, prosecutes discrimination in favor of the small companies."

# Gas Turbine Has First Call If Atomic Power Is Made Industry's Servant, Engineers Told

By William F. Bland
NPN Staff Writer

Atomic power may find one of its first peacetime applications as an agency for driving gas turbines, in the opinion of many members of the Gas Turbine Coordinating Committee of the American Society of Mechanical Engineers.

The committee, which has begun a preliminary study of the place of the world's latest discovery in the field of power sources, is a part of the Oil and Gas Power Division of the A.S.M.E. Its membership is composed of many of this country's leading authorities on gas turbines and includes Arthur E. Pew, Jr., vice president of Sun Oil Co.

"Atomic power is an addition to the world's supply of fuel," said R. Tom Sawyer, chairman of the committee. "It is felt," he continued, "that atomic power certainly will not replace present fuels but will supplement them, as oil supplements coal." Mr. Sawyer, of the American Locomotive Co., is the author of the recently published book, the Modern Gas Turbine.

Members of the committee gave their opinions on the possible applications of atomic power in response to a questionnaire on the subject, at the request of their chairman.

"If we could take a small portion of plutonium and release its power bit by bit into a jet propulsion unit, we would, no doubt, have a plane which would fly from here to China without refueling," said one questionnaire.

While many of the committee members who replied shared the belief of the chairman in the future use of atomic energy for gas turbines, some viewed the field as too highly speculative, or believed security regulations too strict, to warrant exploration by the committee at the present time.

### Two Major Obstacles

Two major obstacles stand in the way of the application of atomic energy in the field of industrial power: the cost of producing this energy will be high at first, and the technical problems involved in using atomic power to obtain mechanical energy through such agencies as the gas turbine will require extensive research.

Advantages in atomic power which might outweigh costs for some applications include probable lighter fuel load, a major factor in aviation but of less importance with reference to costs in railroad locomotives, ships and stationary power, the engineers state.

While committee members feel themselves now "at a new doorway in science opened by the bomb," they note the immediate implication that atomic power's tremendous release of heat offers possibilities for controlled use of such heat in driving a gas turbine.

"In normal gas turbine work temperatures of about 3000°F. must be reduced to the range of 1,000 to 1,500° by the introduction of a large surplus of air," an engineer states.

"With atomic power, temperature far in excess of 4,000° would make necessary the introduction of much larger quantities of air for cooling to a point which the turbine blades can stand. Resistance of turbine blade materials to heat has been improved steadily but, apparently, much additional work in that direction is still required to make atomic power available for gas turbines.

"The possibility exists also that radioactive by-products of the atom-splitting process might make the air unusable in a gas turbine. It appears from this consideration that a semi-closed cycle might be preferred, using the heat created but eliminating the radio-active by-products from the gas turbine."

In the light of recent gas turbine development, engineers visualized a broad pattern of power generation for the near future in which the Diesel would find widest use in sizes below about 2000 kilowatts, and the gas turbine in sizes from about 2000 KW to possibly 20,000 KW. The steam turbine would dominate the large-power field, in unit sizes up to and above 100,000 KW.

"It now seems possible that atomic power may create a unit above 200,000 KW wherein both the gas and steam turbine are utilized in the same plant, using both present fuel and atomic power to achieve the greatest efficiency," Mr. Sawyer believes.

# Penn Crude Association To Expand Research

*Special to NPN*

OIL CITY, Pa.—The Pennsylvania Grade Crude Oil Assn. is broadening its production research program to embrace statistical studies and laboratory experiments with respect to the secondary recovery of oil by water flooding. This announcement was made from the association's headquarters at Oil City, Pa., by Dr. R. V. Hughes, Bradford, Pa., director of the association's production research program.

The Ryder Scott Co., Bradford, petroleum engineers, have been engaged as consultants in the program. Two test wells will be drilled and cored as a result of a preliminary study of operating properties made some time ago. These tests will serve to check calculations previously made of the residual oil content of water-flooded areas.

The association last fall launched a $300,000 secondary production research program to extend three years. Various phases of the program now in operation include water-flood and air-gas repressuring studies at Pennsylvania State Col-

**STA-VOL-ENE** the "Natural" known throughout the World, in Peace, as partner of the automobile, helped develop the transportation that is a vital part of the American-Way of life—in War it did more in helping preserve that freedom . . . . with the return of Peace, STA-VOL-ENE will contribute much to the many new developments forecast for tomorrow.

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## PIONEER NATURAL GASOLINE MANUFACTURER

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lege; corrosion studies at Battelle Memorial Institute, Columbus, O.; Bradford sand and clay investigation at St. Bonaventure College, Allegany, N. Y.; cooperation in well-flowing experiments at the U. S. Bureau of Mines station at Franklin, Pa., and bacteriological and water-flood studies at Penn Grade laboratory at Bradford.

### Greenhouse to Test Chemicals From Shell Laboratories

NPN News Bureau

SAN FRANCISCO—The Shell Oil Co.'s agricultural laboratory at Modesto, Cal., where test work is done on petroleum chemicals as sprays, fumigants, dusts, fertilizers and plant growth substances, is to include a main laboratory building and greenhouse, the company has announced from its San Francisco offices. Work on the new buildings is to start at once. Other greenhouses and a general service building will be built later. It is expected the entire project will be completed early in 1946.

The agricultural laboratory site covers 142 acres which will be planted to deciduous fruits and nuts, truck crops, cereal grains and ornamental plants, to use in the test program. They will be typical of crops raised by growers in 10 western states and Hawaii. Dr. T. R. Hansberry is director of the agricultural laboratory.

## Story Of Sun's Toledo Works Told In Magazine

NPN News Bureau

CLEVELAND—The July-August issue of *Our Sun*, Sun Oil Co. house magazine, is devoted to the 50th anniversary of Sun's Toledo refinery, which until 1902 was the only Sun refinery.

The story of Sun's Toledo plant development that grew from 14 to 270 acres; five early stills transferred into a forest of modern equipment, and a flow of crude, coursing through that equipment, enlarged from a yearly trickle to a torrent that in 1944 was over ten million barrels, is told in pictures and words that is a saga of the development of the entire oil industry.

Interwoven with Sun's Toledo progress is J. Edgar Pew, now at Philadelphia as vice president in charge of crude oil production, whose association with the Toledo organization spanned the years from 1896 to 1901, assisting the late Robert C. Pew, who was in charge at Toledo from the time the refinery became Sun property until his death in 1925.

Among other stories in the anniversary number is one carrying the caption "Kerosene to Gasoline to Fighting Fuel" which traces the development and improvement of motor fuels and engines over a 50 year period beginning in 1895.

Tracing gasoline from the turn of the century, when it was a "nuisance product", on through the days of the Model T Ford when it became the "fair haired product", through World Wars I and II, the story is climaxed with a description of the company's Dynafuel. This, it says, is a product so powerful that no engine yet built can utilize its full potential.

"It may be that refiners 50 years from now will review refinery operations as they exist today and snort, 'Tea Kettles!' If so, it will simply mean that the oil industry again, in more than full measure, has discharged its obligations to society," the article concludes.

### Funeral Rites for S. D. McIlroy, Pioneer Amarillo Oil Man

*Special to NPN*

SAN ANTONIO, Tex.—Funeral services were held in Tolar, Tex., Aug. 28 for S. D. (Tex) McIlroy, 75, Amarillo oil man who died in a hotel here after being ill from a heart ailment for a month.

Mr. McIlroy moved to Texas with his family in 1887 from Arkansas. He went to Alaska for the gold rush ten years later but returned to Texas to enter the oil business.

In 1919 he organized the Dixon Creek Oil Co. with his brother, W. W. McIlroy. This company became the King Oil Co. of Wichita Falls in 1932, with S. D. McIlroy as its president.

### Capt. Cunningham, Port Officer Of Jersey Standard, Dies

NPN News Bureau

NEW YORK—Capt. Harold A. Cunningham, manager of the Port of New York office of Standard Oil Co. of New Jersey, died here on Saturday after a brief illness. He was 61.

Before joining Standard, Capt. Cunningham had spent more than 30 years at sea. He was commander of the famed liner Leviathan until 1931, and later was appointed commodore of the United States Lines fleet. He is survived by a widow and two daughters.

### Rites Held for T. J. Donoghue, Texas Co. Vice President

*Special to NPN*

HOUSTON — Funeral services were held here Aug. 30 for T. J. Donoghue, 76, retired vice president of The Texas Co. and long prominent in Texas oil circles.

Mr. Donoghue died from a skull fracture when he fell on a Houston street after a visit to his doctor's office. He was the first vice president of The Texas Co. and one of the organizers of the company in 1902 following the discovery of the big Spindletop oil field at Beaumont. He had retired from active business in 1939.

Born in Titusville, Pa., in 1869, his first venture into business was selling papers on the streets of Titusville and

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WOOD RIVER OIL AND REFINING COMPANY, INC.

his first permanent job was as a Western Union messenger boy. At 15 he became a clerk for the Standard Oil Co., later learned telegraphy and was an operator for the company.

After his association with The Texas Co. in 1902 he became assistant treasurer of the company, then treasurer, next vice president, and finally first vice-president.

### Oil Man Dies of Heart Attack

*Special to NPN*

HOMERVILLE, Ga. — Dr. Horace Gordon Huey, aged 54, owner of a gas and oil marketing company here, died of a heart attack at his home August 25.

### Rites for Mrs. Hawkins

*Special to NPN*

AUSTIN, Tex.—Funeral services were held here this week for Mrs. W. E. Hawkins, wife of the vice president and general counsel for Magnolia Petroleum Co., who died at her home in Dallas.

### Woodward Estate $8,751,250

*Special to NPN*

HOUSTON, Tex.—The estate of E. F. Woodward, Texas oil man, and his wife has been valued at $8,751,250.10, according to an inventory reported to county court here. The inventory showed $2,152,584.84 in cash and the rest in real estate and other holdings. The Woodwards were killed in an auto accident.

### Five Killed in Explosion During Test of New Well

NPN News Bureau

LOS ANGELES — Five men were killed and a sixth was severely burned in a flash explosion of unknown origin, according to Shell Oil Co., Inc.

The men were running a 2½ inch tubing and packer preparatory to making a production test on the new well near Seal Beach. Damages to the well and equipment have not been determined, but will probably amount to several thousand dollars.

### Indiana Co-Op Buys Oil Land

NPN News Bureau

CHICAGO—Indiana Farm Bureau Cooperative Association has purchased 700 acres of oil lands in Jefferson County, Illinois. Land is known to have had three producing wells with an average production of about 1200 b/d and since land has been purchased three more wells have been brought in bringing total production to over 3500 b/d. Eight offset wells on the new property also are being drilled.

Purchased oil land is approximately 80 miles from newly acquired co-op refinery at Mt. Vernon, Indiana. Steps are now being taken to convert the refinery from a topping to a cracking plant and this is expected to be completed by January 1.

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Most of MILVACO'S production is still serving the needs of the armed forces, but a limited number of the regular commercial line is now available for the urgent requirements of those who want the most in valve value!
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MILWAUKEE VALVE CO.

# Few Bills Unfavorable to Oil Industry and Its Customers Get Through State Legislatures at This Year's Sessions

NPN News Bureau

NEW YORK—Legislatures of 44 states met in 1945 and their actions were not, on the whole, unfavorable to the consumer, distributor and producer of petroleum products. Forty-one of these sessions have adjourned and three—Georgia, Missouri and Wisconsin—recessed.

Legislators indicated, in their caution about levying new taxes and increasing old ones, that they understand that the saturation point for fuel and motorist taxation is near.

Measures to increase the gasoline tax were introduced in 16 states. Only four passed. Idaho authorized a temporary one-cent increase to terminate on March 1, 1947; Iowa a permanent one-cent increase which became effective on July 4 but is now being challenged in the state supreme court; Oklahoma, a two-cent increase to expire on December 31, 1946; and Kansas, a contingent one-cent addition to the gasoline tax if it is found that Federal aid cannot be matched at the present rate.

The proposals calling for increased gasoline tax rates all stemmed from passage of the Federal highway aid act of 1944.

Oklahoma's two-cent increase brings the total levy in that state to 7½c on each gallon of gasoline, excluding the 1½c federal tax.

Gasoline-tax-increase bills passed one house in the Connecticut, Texas and Washington legislatures but died in the other.

**This NPN survey of 1945 actions of state legislatures affecting the oil industry was prepared to give readers an up-to-the-minute picture of the attitude of state governments toward the industry and those who consume its products so that individual oil men and their associations will know what may be under consideration in their own states two or four years from now**

Six states — Florida, Massachusetts, Pennsylvania, New York, Ohio and West Virginia—continued emergency taxes levied during the last few years. In the case of Pennsylvania, the one-cent temporary tax on gasoline has now been earmarked for the road fund, abandoning the previous practice of diverting this tax.

More and more states are joining the 16 which have adopted constitutional amendments dedicating highway revenues for exclusive highway use. Last year Maine and Washington became respectively, the fifteenth and sixteenth states to join the list. On November 6 of this year the people of Kentucky and Pennsylvania will vote on similar amendments to their constitutions. The Pennsylvania legislature at its 1945 session again approved—this time unanimously—such an amendment. Similar action had previously been taken in Kentucky.

Indiana and Tennessee, too, are well on the way to placing an ironclad safeguard around their highway tax dollars. For during the past legislative sessions anti-diversion amendments were initiated in those states. In each case, however, they must be approved again by the legislators before presentation to the voters.

Although supported by the governor, a similar amendment, which already passed one legislative session, met defeat in Connecticut on the second and final try. Texas is getting ready to vote on an anti-diversion amendment in November of 1946. In this case, though, 25 per cent of motor fuel revenues will continue to be allocated to the school fund.

Wisconsin was added to the list of states which segregate highway funds by statute. A measure with this purpose was salvaged and passed after it had fallen into troubled waters with a governor's veto.

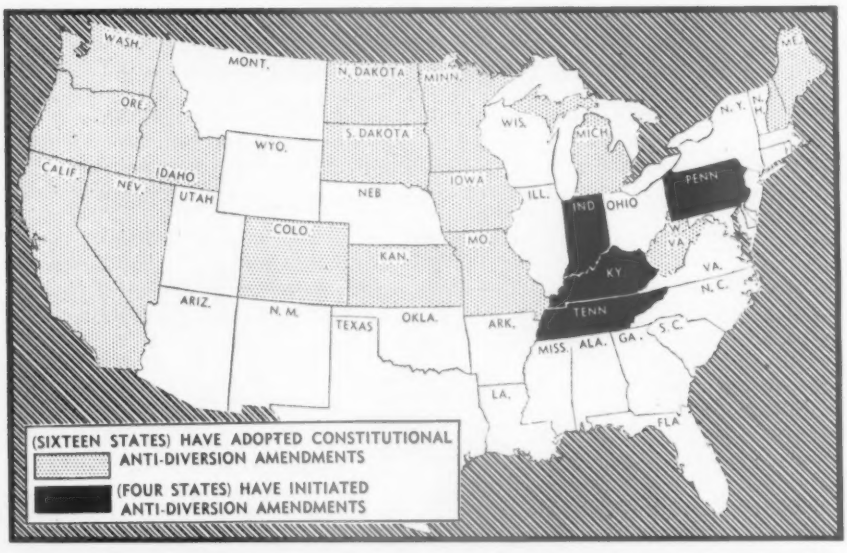
Although 20 states considered legislation involving fuel used by airplanes, little changes affecting the taxation of this product were brought about. Many of these 20 states introduced legislation calling for the taxation of aviation fuel. Only two such bills passed. Montana voted the retention of one cent of the usual five-cent refund on aviation gasoline, revenue from this tax to be spent for the benefit of aviation. Minnesota levied a graduated tax on aviation gasoline ranging from one-half to four cents, based on annual purchases. Alabama and Pennsylvania earmarked the tax on aviation gasoline for aeronautical purposes and required oil companies to report airpore deliveries. Nebraska provided that all of its five cent tax on aviation gasoline must be used for aeronautical purposes. Previously, one cent of the tax was diverted to old age assistance.

The four states which increased the gasoline tax—Idaho, Iowa, Oklahoma and Kansas—made widely varying provisions, or no provision at all, for aviation fuel. Iowa will refund the new one-cent tax; Kansas, if the increase becomes effective will not, although aviation fuel remains exempt from the regular three-cent state levy; Idaho did not subject aviation fuel to the tax increase; Oklahoma made no specific exception for aviation gasoline.

Allowances under state gasoline taxes for one purpose or another also came under the scrutiny of legislators, sometimes adversely, but in most cases without the enactment of new laws. Included in this category are the states of Arkansas, Connecticut, Delaware, Indiana, Kansas, Massachusetts, South Dakota, Tennessee, Washington and Wisconsin, which considered measures affecting allowance for evaporation, shrinkage, spilling and other causes.

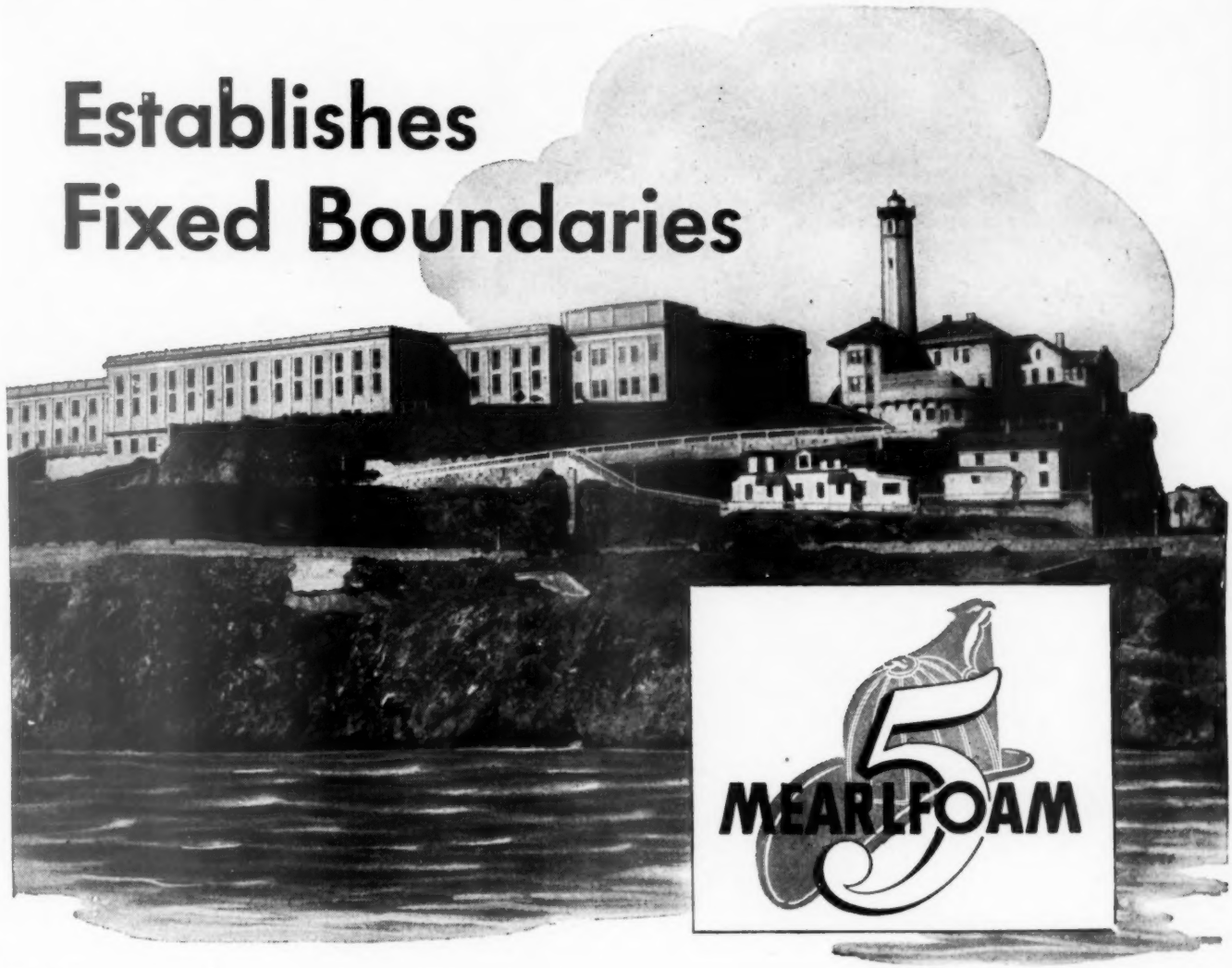
South Dakota passed a law permitting distributors to credit themselves directly

## *16 States Dedicate Highway Revenues for Highway Use*




**Sixteen states now have constitutional amendments reserving highway revenues for highway purposes. Maine and Washington joined the list last year. Kentucky and Pennsylvania will vote on anti-diversion amendments Nov. 6. Indiana and Tennessee have taken preliminary steps toward adoption of such constitutional amendments**

# Establishes Fixed Boundaries




WASHED by the waters of San Francisco Bay, the "Rock" is law and order's way of establishing fixed boundaries for offenders. And in no less positive manner, a ring of MEARLFOAM-5, the war-born, blended multi-protein mechanical (air) foam deprives fire of its freedom and establishes its fixed boundaries, too.

When MEARLFOAM-5 puts out the infernos of blazing gasoline and oil fires they stay *put out*. Should any rupture or break occur in the dense foam blanket as the result of shipboard pitch or falling debris . . . this live, long-lasting foam remains mobile and the rupture automatically heals. Even when the blanket of MEARLFOAM-5 has aged it still retains its fire-resistance. For example:—when after aging, a hole deliberately is cut in the foam blanket (for demonstration purposes) and the gasoline or oil is reignited, the surrounding blanket confines the fire and prevents its spreading beyond the foam-circled area.

The many unique and dependable properties of MEARLFOAM-5 are the sole reasons the U. S. Navy uses it extensively for preparedness . . . and for the quick extinguishment of raging gasoline and oil fires on shipboard and at shore bases. MEARLFOAM-5 is the veteran of many successful engagements, and one day will demonstrate to all—the super effectiveness of mechanical (air) foam as the most successful, modern method for combatting gasoline and oil fires. MEARLFOAM-5, after putting fire out—*keeps it out*... totally eliminating the flash-back hazard which in the past has taken such a terrible toll of lives and property.

MEARLFOAM-5 is a good-mixer—with any type of water. It works at maximum efficiency in any climate or atmospheric condition. So that—when split-seconds count—you can rely on MEARLFOAM-5 to put fire out fast—to keep fire out *permanently!*

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for losses of gasoline instead of applying for refunds. In Delaware a bill was introduced providing for a two per cent allowance for collection costs, in addition to the one per cent now granted for shrinkage and evaporation. It passed the legislature but was accorded a pocket veto by the Governor.

Massachusetts authorized by statute the one per cent gasoline tax collection allowance previously permitted under regulations.

### Refunds and Exemptions

About 90 measures concerning refunds and exemptions of motor fuel taxes were introduced in 34 states. Two states were added to the number granting refunds in whole or in part on gasoline for all or for certain non-highway purposes, but no state was added to the group of three now granting outright tax exemptions.

The legislatures of Indiana and Maine followed a growing movement when they abolished requirements that applications for tax refunds on motor fuels be supported by notorized oath. Of special interest to farmers and other rural people, these laws allow applicants to forward to the proper state official, along with application for refund, a signed statement that the application figures are correct.

Rhode Island now extends the refund privilege to commercial fishermen, farmers and lumbermen. A bill to refund five cents of the six-cent gasoline tax in South Carolina when the fuel is used in farm operations was passed over the governor's veto in that state.

Refund bills for farm use passed the Arkansas and Utah legislatures but met with defeat at the hands of the governors of the two states. Failure to muster enough votes to pass resulted in defeat of proposed legislation which would substitute exemptions for refunds in Colorado, Michigan, New Mexico and Texas.

### Liquefied Gas

The subject of liquefied gas, too, was in for its share of legislative prominence. Of all such bills enacted, the most objectionable was a Florida measure to permit cities and towns to levy taxes up to 10 per cent of the selling price of utility services, including bottled and liquefied petroleum gas. And, although it was later eliminated, at least one Florida city (Clearwater) included fuel oil within the purview of a local ordnance stemming from the state enabling act.

Measures to regulate the storage and transportation of liquefied gas became law in Connecticut, Colorado, Idaho, Oklahoma and Texas.

### Inspection Fees Reduced

Two states—Nebraska and South Dakota—reduced their inspecion fees for petroleum products. In Nebraska the fee on gasoline, kerosine and other petroleum products used for heating, illuminating, cleaning and power was cut from one and one-half cents to one cent per 50-gallon barrel.

South Dakota reduced the inspection fee on all petroleum products from two and one-half cents to one and one-fourth cents per 50-gallon barrel.

Ten states considered legislation relating to the taxation of chain stores but only two—Alabama and Iowa—finally enacted measures in this field. In Alabama the exemption of service stations from the chain store tax was preserved by amendment of a bill which would have terminated the present exemption.

In Iowa companies that have paid chain store taxes on bulk stations may obtain rebates.

The other eight states active in this respect were Arkansas, Florida, Minnesota, Missouri, Montana, Tennessee, Texas and West Virginia.

### Facilities on Limited Access Highways

Another significant role played by legislators this year concerned constructive legislation for service station facilities for motorists using limited-access highways. New Jersey took the lead in this field when it passed legislation which would have the effect of keeping commercial enterprises off the state-controlled rights-of-way along such roads. Pennsylvania, New Hampshire and Indiana followed.

Sixteen states in 1945 either liberalized laws regulating truck weights and sizes or gave permanent status to temporary wartime measures of this type. The 16 states are: Arizona, Colorado, Florida, Iowa, Kansas, Minnesota, New Hampshire, North Carolina, North Dakota, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Vermont and Wyoming. Nebraska and Oregon extended their liberalized truck laws for another two years.

Full motor vehicle reciprocity, too, made substantial advances. Arkansas and Indiana authorized special commissions to negotiate with appropriate officials of other states for reciprocity agreements. Minnesota and Maine enacted full reciprocity laws, the latter for a two-year period; and New Hampshire made its reciprocity law permanent.

### Miscellaneous Legislation

Miscellaneous legislation of interest to the petroleum industry included:

Passage of a law which provides that foreign corporations may now own or lease as much land as is necessary in Nebraska, outside corporate limits of cities and towns, for establishments primarily operated for storage, sale, or distribution of petroleum products. In Georgia a measure passed which permits foreign corporations to own mineral rights in excess of 5,000 acres.

The 75 per cent reduction in privilege and pump taxes in North Carolina was continued for another 2 years. Oil conservation laws and severance taxes were enacted in North Carolina, Alabama and Florida. The legislatures of Florida, Montana, and West Virginia authorized membership in the Interstate Compact to conserve gas and oil. Indiana and Wisconsin enacted legislation to require the labeling of reclaimed oil. Several measures which would have prevented service stations from undertaking even minor repairs on motor vehicles, or would have imposed severe regulations on this work, were introduced in various states; but none became law.

### State-by-State Summary

Following is a state-by-state summary of the more important 1945 state legislative actions affecting the petroleum industry:

**ALABAMA**

Confirmed by Statute the regulations permitting bonded dealers to pay tax on gasoline sales rather than on receipts where transfer is between bonded dealers.

Earmarked tax on aviation gasoline for aviation purposes and required oil companies to report airport deliveries.

Enacted oil and gas conservation law, financed by a 2% tax on production.

Levied a 4% severance tax on gas and oil.

Exemption of service stations from the chain store tax was preserved by amendment of a bill otherwise modifying the state law.

Provided reserve of $2,500,000 for use by counties in equal shares to match federal secondary road funds, also set aside 1/67 of 1c of state gasoline tax receipts for each county for the 3 postwar years.

**ARIZONA**

Liberalized truck weight laws by introducing the formula 850 (L plus 40) in place of the former 18,000 lb. axle limitation.

**ARKANSAS**

Amended specifications of tractor fuel to provide slightly more volatile product.

Revoked 1943 provision that $1 license fee was in lieu of all other occupation taxes on distributors.

Authorized interstate reciprocal agreements with respect to the operation of motor vehicles.

**CALIFORNIA**

Liberalized its truck weight laws and now permits 68,000 lbs. in lieu of 64,000 lbs. on basis of the formula used.

Amended the definition of distributor of motor fuel.

Required vehicles carrying explosives, inflammables or poisonous gases to be so marked.

Provided that no city ordinance shall prohibit commercial vehicles from using any street on a direct route to a non-restricted street for the purpose of delivering or loading goods or merchandise.

Provided for issuance of prospecting permits for state-owned tide and submerged lands.

**COLORADO**

Provided for the regulation of storage and transportation of liquefied petroleum gas.

Increased permissible weight of vehicles as follows: 2 axles from 24,000 to 30,000 lbs.; 3 axles from 34,000 to 46 000 lbs.; permits 3 unit combinations; bases the gross weight on the formula 800 (L plus 40).

**CONNECTICUT**

Allowed one year for federal refund claims on gasoline used for non-highway purposes.

Authorized Commissioner of State Police to regulate storage and transportation of inflammable liquids.

Provided that pre-heated petroleum products be measured by weight and specified contents of delivery tickets.

**DELAWARE**

Repealed time limit on claims for refunds.

Provided for special permits for overweight motor vehicles.

**FLORIDA**

Joined interstate compact to conserve oil and gas.

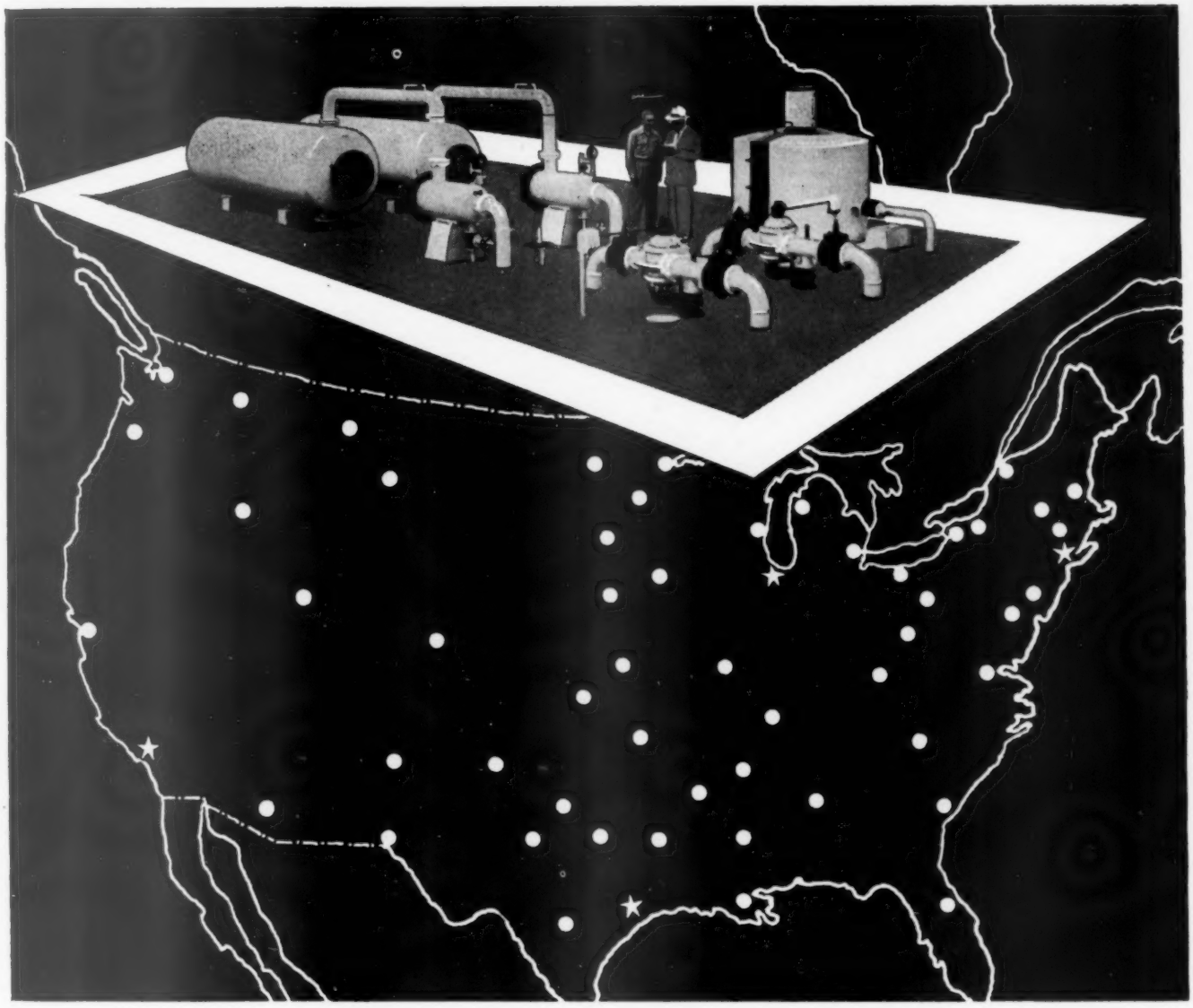
Increased permissible truck weights as follows: single units from 16,000 to 40,000 lbs.; combinations from 32,000 lbs. for private vehicles and 40,000 lbs. for "for-hire" trucks to 60,000 lbs. Increased heights from 12 to 12½ ft. and lengths of combinations from 45 to 60 ft.

Temporary 1c gasoline tax was continued to June 30, 1947.

A tax up to 10% was authorized to be levied by municipalities on bottled gas.

Established a state Board of Conservation to deal with oil and gas.

Severance tax of 5c per barrel or 5% of



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value of oil and 5% of gross value of gas produced was levied.

Mileage tax on common and contract carriers was reduced from 1c to ¾ of a cent.

Exemption from gasoline tax was continued on deliveries in excess of 500 gallons to the Federal government.

### GEORGIA

Adopted a new state constitution which has been approved by the voters.

Clarified fuel tax law so that kerosine when used in motor vehicles will be subject to tax at 6c per gallon and not 7c as it was under certain interpretations of the law.

Permitted foreign corporations to own the mineral rights in more than 5,000 acres without incorporating in Georgia.

Provided for 6% interest on tax refunds.

Information and records pertaining to motor fuel tax law were made public records by amendment of the secrecy provision of the general law.

Provided for distribution of highway funds to counties in specified amounts, rather than on a percentage basis.

Several aviation bills were held over until 1946.

### IDAHO

Repealed one mill per gallon gasoline tax.

Increased gasoline tax from 5c to 6c per gallon until March 1, 1947.

Regulated transportation and storage of liquefied pet oleum gas.

Provided that unexpended balances of motor fuel tax in hands of highway and good roads district treasurer after debt service requirements be retained for maintenance instead of returned to state highway fund.

Provided for a refund of gasoline tax on motor fuel used for cleaning and dyeing purposes—only where purchases were in amounts of 50 gallons or more.

### ILLINOIS

Increased permissible truck lengths—single units from 35 to 42 ft.; combinations from 40 to 45 ft. Also permits tractor and semi-trailer gasoline loads of 18,000 lbs. instead of 16,000 lbs.

Adopted resolution against diversion of highway funds.

Provides for calibration of tanks of any capacity (previously 2500 gallons) and reduced fee from $5 to $2.50 per thousand gallons of capacity.

Broadened law regulating sale of reclaimed oil and provided for injunctions against violators.

Enacted motor vehicle financial responsibility act with provision for self-insurance of fleet owners.

### INDIANA

Adopted, subject to passage by the 1947 legislature, amendment to constitution prohibiting diversion of highway revenues to other than highway purposes.

Extended time for filing gasoline tax refund claims from 3 to 4 months, and generally simplified refund procedure.

Required reclaimed oil to be so labeled and provided for injunctions against violators.

Created motor vehicle reciprocity commission.

Provided for establishment of municipal parking facilities.

Required all gasoline and motor fuel funds to be specifically appropriated.

### IOWA

Made permanent the temporary truck weight limits with axle loads increased from 17,000 to 18,000 pounds and revised formula to allow greater gross weights.

Increased gasoline tax from 3c to 4c per gallon.

Permitted companies to obtain refund of over payments of chain store tax previously paid in error.

### KANSAS

Provided for increase of 1c per gallon in gasoline tax on proclamation of the governor if it is found that additional funds are necessary to match Federal aid highway funds.

Permitted tractor-semi-trailers to be classified as combinations thus permitted 45 foot instead of 35 foot lengths.

Required gasoline tax exemptions claims to be in hands of the Director of Revenues within 90 days instead of in the hands of the distributor.

### MAINE

Enacted for a two-year period a comprehensive motor vehicle reciprocity law.

Repealed requirement that motor service stations (auto clubs, etc.) pay an annual license fee.

Provided for reissuance of highway bonds in amount of $1,726,500 per year for two years for highway construction and maintenance and to match federal funds.

Established a town road improvement fund to be financed by up to 10% of annual average of gasoline tax and registration fees over preceding 5 year period.

### MARYLAND

Extended time within which claim for refund of gasoline tax may be made from 90 days to one year.

Included fuel used in Diesel engines on highways in the definition of motor fuel so as to subject it to the 4c tax.

Authorized local agencies and political subdivisions to do all things necessary to comply with Federal Aid highway act and to raise funds by bonds, interim certificates and taxes.

### MASSACHUSETTS

Authorized by Statute the 1% gasoline tax collection allowance previously permitted under regulations.

Permitted pipelines to be constructed under state property.

Continued 1c temporary gasoline tax to June 30, 1952, in spite of efforts to make it permanent.

Provided for 6 year postwar highway program entailing expenditure of $156,000,000 to be financed from the 3c gasoline tax.

Doubled the corporation tax on corporations clearing over $25,000 to finance a bonus program.

### MICHIGAN

Redefined contract motor carrier of property, excluding employees, agents or factors engaged in distributing merchandise, even though the amount paid to a carrier may include an amount for transportation or for vehicles used.

Exempted from the sales and use tax sales of bunker and galley fuel to vessels of 500 tons or more when used in interstate commerce.

Revised the intangibles property tax law, clarified the term property with a situs in the state; reduced rate from 5% to 3%.

Continued 3c per gallon tax on aviation gasoline with refund of 1½c to interstate operators.

### MINNESOTA

Provided for self-insurance of motor vehicles by fleet owners.

Permitted increased truck weights by raising the factor on the gross weight formula from 700 to 750 (L plus 40).

Imposed a 4c per gallon tax on aviation fuel subject to refunds of from 1c to 3½c according to annual gallonage purchased.

Provided for full reciprocity for "for-hire" motor vehicles.

Included brake testing among items to be covered by semi annual motor vehicle inspection.

Provided that postmarked date be accepted as the filing date on claims for gasoline tax refunds.

Permitted refunds on motor vehicle registration fees on basis of the unexpired portion of the tax year.

Authorized issuance of highway construction bonds or warrants to be paid out of anticipated gasoline tax revenues.

Authorized county boards to use 25% of shares of gasoline tax revenues to pay for bonds issued for road or for federal matching purposes.

### MISSOURI

Still in session.

### MONTANA

Joined the Interstate Compact to conserve oil and gas.

Required users of Diesel fuel for highway purposes to secure use fuel permits.

Enacted a motor vehicle dealer license bill, requiring new car dealers to maintain repair and display facilities and used car dealers to have established places of business.

Authorized up to $12,000,000 of highway treasury anticipation debentures to match federal aid to be financed by 5c gasoline tax.

Prohibited diversion of highway funds to other than highway purposes.

Established an Aeronautics Commission, authorized state ownership and operation of aviation facilities and authorized retention of 1c of the tax on aviation fuel which was formerly refunded.

### NEBRASKA

Reduced oil inspection fee on 10 barrels or more from 1½c to 1c per barrel.

Permitted foreign corporations to own or lease land within the state, outside of city limits, for the purpose of establishing petroleum bulk stations or service stations.

Extended the present temporary truck weight limits to March 1, 1947.

Extended war emergency provisions permitting transportation of petroleum products on Sundays and holidays.

Authorized 1 mill tax levy by counties to obtain funds to match federal highway moneys.

Provided that all of the 5c tax on aviation gasoline must be used for aeronautical purposes. (Previously 1c was diverted to old age assistance.)

A bill licensing motor vehicle dealers was amended to strike out motor vehicle repairers.

### NEVADA

Authorized Public Service Commission to license contract and common carriers on a monthly basis and to extend trip permits for out-of-state carriers from 48 to 96 hours.

### NEW HAMPSHIRE

Made permanent former temporary motor vehicle reciprocity law.

Single vehicle lengths were increased from 33 to 35 ft.

Enacted a limited access highway law and included a provision prohibiting commercial activities thereon by the state.

Prohibited operation of trucks other than pet oleum transporters equipped with other than standard fuel tanks.

### NEW JERSEY

Enacted a limited access highway law and included provision prohibiting operation and authorization of commercial enterprises by the state.

Provided for a corporate franchise tax.

Established a single fund for all state revenues.

### NEW MEXICO

Provided for acceptance of postmarked dates on gasoline tax reports mailed on or before the 25th of the month.

Reduced mileage tax by defining tractor and semi-trailer as one unit and exempted gasoline transports from paying mileage tax on return trips.

Prohibited new carbon black plants within 5 miles of municipalities.

### NEW YORK

Continued temporary gasoline taxes (2c) to March 31, 1946.

Provided that weight restrictions shall not apply to semi-trailers.

Authorized construction of bus and car terminals by the New York City Tunnel Authority.

Established ceiling on rents of commercial properties.

Amended unemployment insurance law to provide for refunds based on experience factor.

### NORTH CAROLINA

Continued 75% reduction in pump and service station taxes.

Increased weight limits on vehicles with 4 or more axles from 40 to 50,000 lbs.

Increased lengths of combinations from 45 to 48 ft.

Provided that sales of lubricants, repair parts, accessories and other articles used in servicing motor vehicles and airplanes when made to owners of fleets of 5 or more shall be classified as wholesale sales under sales tax law and subject to 1/20 of 1% rate instead of 3% retail rate.

Established a petroleum division within the State Department of Conservation and Development.

Adopted oil and gas conservation act and

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authorized a production tax of up to 5 mills per barrel on oil and ½ mill per 1000 cubic feet of gas.

Required registration and bonding of drilling operators engaged in exploration.

### NORTH DAKOTA

Permitted increased truck weights by adopting the formula 750 (L plus 40).

Combination lengths were extended from 40 to 45 ft.

Reduced mileage tax on interstate carriers.

### OHIO

Made permanent the liberalized temporary truck weight law.

Continued 1c temporary gasoline tax to March 31, 1947 after repeated attempts to have it made permanent.

### OKLAHOMA

Provided for regulation and storage of liquefied petroleum gas.

Increased gasoline tax from 5½c to 7½c on a tempora y basis until Dec. 31, 1946.

Reenacted without an expiration date tax of 1 mill per barrel on petroleum produced for the conservation fund.

Exempted from sales and use tax laws machinery and equipment used in establishing new manufacturing plants.

Exempted from motor fuel taxes naphthas and solvents in quantities of 50 gallons or more when used for cleaning, dyeing, the manufacturing of paint or rubber goods.

Provided for transfer of 1944-45 general fund surplus to highway fund.

### OREGON

Provided for self-insurance of motor vehicles by fleet owners.

Extended to July 1, 1947 authority of the Highway Commission to permit excess weights and lengths of trucks.

Strengthened fuel use tax law by requiring users to file a bond or deposit cash.

Postmarked date on reports required under gasoline tax law will be considered filing date.

### PENNSYLVANIA

Adopted amendment to constitution prohibiting diversion of highway revenues to other purposes. This will be submitted to the people at an election in November 1945.

Eliminated diversion of highway funds.

Made permanent temporary truck weights and continued the 1c tempo:ary gasoline tax to May 31, 1947.

Tax on aviation gasoline earmarked for aeronautical purposes.

Enacted a limited access highway bill containing a provision prohibiting the operation or authorization of commercial enterprises by the state.

Allocated $17,000,000 to subdivisions other than counties for road purposes on a dollar basis rather than on a percentage of gasoline tax collected.

Authorized complete survey of highway finances.

### RHODE ISLAND

Provided for refund of gasoline tax to commercial fishermen, farmers and manufacturers when fuel is used in vehicles not on the public highways.

### SOUTH CAROLINA

Exempted, except for 1c per gallon gasoline purchased for use in farm equipment.

Lengths of single vehicles were increased from 35 ft. to 40 ft. and on combinations from 45 ft. to 50 ft. Permitted single vehicles of 32 000 lbs. and combinations of 50 000 lbs. as against the former 25,000 and 40,000 lbs., respectively.

Corporate franchise taxes reduced by 1 mill and registration of motor vehicles by the City of Charleston was authorized.

Provided highway department shall take over 5% of county roads in each of the next 3 years, redistributed 1c of gasoline tax among the counties on the basis of mileage, motor vehicle license fees, population and property valuation.

### SOUTH DAKOTA

Reduced inspection fee on petroleum products from 2½c to 1¼c per 50 gallon barrel.

Reduced penalties on reports by dealers.

Extended time within which claims for losses by reason of leakage may be filed from 24 hours to 5 days.

Eliminated initial boiling point requirement in t actor fuel specifications.

Exempted from sales and use taxes motor fuel, tractor fuel, kerosine and distillate when used for agricultural purposes.

Permitted use of duplicate invoices in support of refund claims.

Specified that profits of state cement plant after designated reserves be turned over to the highway fund.

### TENNESSEE

Raised truck weight limits from 30,000 lbs. to a gross weight limit of 42,000 lbs. based on the formula 700 (L plus 40). Single unit lengths increased from 27 to 35 ft., combinations from 35 to 45 ft.

Provided for economic regulation of air carriers by Bureau of Aeronautics and Public Works.

Restricted to aeronautical purposes tax on aviation gasoline.

Adopted an amendment to constitution subject to approval by the 1947 legislature against the diversion of highway revenues.

### TEXAS

Adopted amendment to constitution to prohibit diversion of highway revenues, which will be submitted to voters at 1946 election.

Voided old 38,000 lb. truck weight limit by permitting gross weights up to 48,000 lbs. based on the formula 700 (L plus 40), and subject to 18,000 lb. axle limitation.

### UTAH

Specified a minimum of 5 miles per gallon in computing use fuel tax on the basis of mileage travel.

Authorized the State Land Board to join in coope ative or unit plans for the development of gas and oil property.

### VERMONT

Adopted tank truck specifications as part of the code for regulation of inflammable carriers.

Made permanent temporary 12½ ft. height allowances for trucks.

Dedicated proceeds of aviation gasoline tax to Aeronautic Commission.

### WASHINGTON

Required tank trucks carrying inflammables to be so marked and their contents to be indicated.

Provided for allocation of excise tax on freight and passenger carriers on basis of mileage within and without the state.

Authorized state research in municipal government to be financed by part of cities' shares of the motor vehicle fund.

### WEST VIRGINIA

Joined Interstate Compact to conserve oil and gas.

Extended 1c temporary gasoline tax to June 30, 1947.

Authorized establishment of municipal parking facilities.

Provided for reissuance of $15,000,000 in road bonds as part of "good roads revolving fund"; $7,000,000 to be used to match federal funds, balance to free toll bridges.

### WISCONSIN

Provided for segregation of highway funds and eliminated diversion.

Revised law pe taining to sale of reclaimed oil and provided for injunctions against violators.

Provided for self-insurance of motor vehicles by fleet owners.

### WYOMING

Exempted wholesale sales to United States in excess of 300 gallons from gasoline tax.

Provided for increased truck weights by increasing formula factor from 600 to 850 (L plus 40). Length of tractor-semi-trailer of 50 ft. and truck and trailer of 60 ft. were permitted against the former 45 ft. limitation on both types.

Amended the use tax law to require registration of dealers before making or soliciting sales.

Required retailers to keep records for 3 years for sales tax purposes.

Permitted use of reflectors by trucks which are required by law to carry flares.

Exempted from use tax any articles subject to a tax of more than 20% imposed by the federal or state governments (this law formerly read "20% or more").


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FIRE PREVENTION AND VAPOR CONSERVATION EQUIPMENT FOR VOLATILE LIQUID STORAGE TANKS

# Qualified Veterans Must be Rehired And May Not be Discharged Without Cause For A Year

*By Elwin E. Hadlick*

This is the fourth and concluding article in a series devoted to consideration of the rights of returning veterans to return to their old civilian jobs. In the three preceding articles the provisions of Section 8 of the Selective Training and Service Act of 1940 have been almost completely analyzed. The few remaining features of that section and the relationship of other applicable laws will be considered in this final article.

Mr. Hadlick

The Selective Training and Service Act of 1940 requires simply that a veteran who complies with the rules be re-employed. It mentions no time within which the re-employment must take place. However, Selective Service says that the law means that the re-employment must be immediate. It does allow the lapse of a reasonable time within which any necessary medical examinations may be made, but it allows no leeway for the convenience of the employer.

Having once been re-employed, the veteran is entitled to participate in insurance or other benefits offered by the employer pursuant to established rules and practices relating to employees on furlough or leaves of absence in effect with the employer at the time the returning veteran was inducted into the armed forces. While there are some situations in which some problems may arise, it appears that, technically speaking, this requirement of the law will not cause any real difficult problems.

### May Not Be Discharged

There is one more specification to the effect that when re-employed the veteran may not be discharged from his restored position without cause within a year after such restoration. There will undoubtedly be many situations where an employer may well wonder what constitutes cause for discharge. Many employers have the problem pretty well outlined for them by provisions in union contracts which designate not only the causes for which discharges can be made but the manner in which the existence of such causes shall be determined. In employment situations where there is not a union contract or other proper plan, the facts and circumstances of each case will have to be studied in the light of common sense and the usual practices and customs not only in the industry but in the community.

While there are innumerable additional situations and questions which can be imagined and which actually will arise in the administration of the law, the foregoing will cover most of the points in the law under which disputes will come.

A recent publication by a civic organization which has maintained an excellent service for the benefits of its employer members repeats the advice given in the first of this series of articles that every employer should designate one qualified individual charged with the responsibility of being familiar with existing provisions of the subject of veteran re-employment.

**In his 77th article appearing exclusively in NPN on warlime compliance regulations, Elwin E. Hadlick, prominent attorney and oil association president, writes the fourth in a series on the timely subject of job rights of returning veterans. In this article he completes his analysis of laws pertaining to the rights of returning veterans.**

The publication goes further though and suggests definition of the matter by employers into its logical phases. It suggests that each employer set up first, a statement of policy and procedure; second a system for preparation of proper case histories which will lead to correct placement, next a procedure for following up on the performance of the returning veteran and his ultimate transfer into the most appropriate job to utilize his ability and skill, next a program of assistance in helping the veteran to take full advantage of his rights under the law to education and training, and finally a record of seniority.

### Seven Laws on Returning Vets

It was said at the outset that there are 7 laws relating to the matter of re-employment of returning veterans. Thus far the provisions of the Selective Training and Service Act of 1940 have been considered, because they are the basic foundation for an approach to this subject. An employer will know practically all he needs to know if he is familiar with the provisions of that law.

The Army Reserve and retired personnel service law of 1940 simply provides the same privileges to the reserve and retired personnel as are applied under the Selective Training and Service Act of 1940 to persons who were inducted into the land or naval forces.

The service extension act of 1941 carries forward the date line of the provisions of Section 8 of the Selective Training and Service Act of 1940, so as to make the provisions of that law effective as to persons entering the armed forces after May 1, 1940.

The act, known as Merchant Marine-Re-employment Upon Termination of Wartime Service, provides re-employment provisions for those who leave their positions in the Merchant Marine, and the Women's Army Corps law carries a provision that the re-employment benefits applying to men shall apply to women.

The G. I. Bill of Rights, technically known as the Service Men's Readjustment Act of 1944, Public Law 346, 2nd Session of the 78th Congress, carries forward the idea of re-employment by providing for "an effective job counseling and employment placement service for veterans." It approaches the matter not only from the standpoint of the right to re-employment but from the standpoint of getting the veteran placed in the most suitable type of work. This particular law contains many provisions not pertinent to the subject being discussed here.

Finally, the War Mobilization and Reconversion Act of 1944 ties together the handling provided for veterans and consolidates functioning under a retraining and re-employment administration.

### No Distinction on Volunteers

It has been the purpose of these articles to point out that any person, male or female, who entered active duty in the land or naval forces of the United States subsequent to May 1, 1940, is entitled to re-employment under the conditions which are set forth in the law. The various acts of Congress extend this coverage to all members of the Army, Navy, Marine Corps, Coast Guard, and to the Merchant Marine, and it makes no difference whether the returning veteran was a volunteer or was drafted.

The only group affected in any way by the military service program who are not eligible to re-employment are members of the coast guard auxiliary and conscientious objectors who were assigned to work of National importance in lieu of military service. Of course, the Federal government cannot control the activities of state governments or political subdivisions thereof; consequently, employees of such agencies are subject to whatever rules the agencies set up,

but Congress indicated clearly that it hopes that the states and other political departments will follow the spirit of the law. It is provided that the personnel of the Federal government agencies is to exert every effort to secure reemployment for former employees of state and other political governments.

### Different Discharge Forms

An employer who is approached by a former employee who was not on a temporary basis who is in possession of a certificate of completion of satisfactory service has some obligations. This certificate of completion of satisfactory service may be called a Certificate of Service if issued by the Army to persons transferred to the Reserve Corps, or may be called a report of separation, or may be called any one of a number of forms of honorable discharge or may be called a certificate from the administrator of the war shipping administration if issued to a merchant seaman. The returning veteran who has the certificate and who appears to be still qualified to perform the duties of his old position and who applies for the right to do so within 90 days after being relieved from service or from hospitalization continuing after a discharge for a period of not more than one year is entitled to his old position or to a position of like seniority, status and pay unless the employer's circumstances have so changed as to make it impossible or unreasonable for him to comply.

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## Digest of Week's Oil Orders

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**CODE: AO—Administrative Order; CMP—Controlled Materials Plan; D—Directive; FDO—Food Distribution Order; GMPR—General Maximum Price Regulation; GO—General Order; Interp.—Interpretation; L—Limitation Order; M—Conservation Order; MPR—Maximum Price Regulation; P—Preference Rating Order; PAO—Petroleum Administrative Order; Pri. Reg.—Priorities Regulation; Proc. Reg.—Procedural Regulation; PS—Price Schedule; RO—Ration Order; RPS—Revised Price Schedule; SO—Supplementary Order; SR—Supplementary Regulation.**

At Peleliu, Marines of the famed First Division "hit the beach" behind a GMC "Duck." Official U. S. Marine Corps Photo

GMC started to produce "Ducks" at about the same time that the Marines started to "jump all over the Japs" in the Pacific. Since then, the Navy's amphibious fighters have used GMC's amphibious trucks in a score of successful assaults from Guadalcanal to Guam.

At Arawe and Cape Gloucester, invasion beaches were blasted by a blazing barrage fired from "Ducks" equipped with rocket guns. At Saipan and Tinian, Leathernecks used many of these "landing boats on wheels" to help stage the surprise attack that put big B-29s within bombing distance of Japan. At Iwo Jima and Okinawa, the Marines were supported by GMC "Ducks" through some of their fiercest Pacific fighting.

The "Duck" made an ideal transport vehicle for island hopping "Devil Dogs" because, boat and truck combined, it followed the fighting through sea, surf, coral sand and jungle swamp.

In addition to being one of the largest producers of military vehicles, over 575,000, GMC is building many commercial trucks for essential users. Civilian GMCs are powered by engines of the same basic design as the famous "270," used in the GMC "six-by-six" . . . the "Workhorse of the Army."

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**ADJUSTING PRICES AND DISTRIBUTION OPERATIONS OF KEROSENE AND OTHER FUEL OILS — RMPR 137, Am. 12** — The maximum prices for kerosene, in any rationed area other than specified Atlantic Area (subdivision [i] of section 10) may be increased .3 of a cent per gallon, total adjustment to the nearest cent — issued 8-21, effective 9-1.

**MAXIMUM PRICES OF AVIATION GASOLINE IN CALIFORNIA, WASHINGTON AND OREGON — MPR 137, Order 5** — Where dealer in Calif., Ore., or Wash. made no sales of aviation gasoline below 87 oct. from a retail establishment in March, 1942, his ceiling is his highest price charged to a purchaser of the same class at the establishment during December, 1941 for each grade of aviation gasoline below 87 oct. Airport dealers in these 3 states must file with OPA, Los Angeles, within 15 days, a statement of ceilings determined under this order — issued 8-23, effective 8-28.

**CHANGES IN SUBSIDY LIST — RMPR 436, Am. 6 to Order 37** — Increased subsidy prices of crude from additional stripper pools listed in Arkansas, Illinois, Kansas, Michigan, Oklahoma, Texas and Wyoming — issued 8-24-45, effective 8-1-45.

**NEW COMBAT AND RUN-FLAT TIRE MAXIMUM RETAIL PRICES — RMPR 528, Order 56**—Retail ceilings on New Combat and Run Flat tires, range from sizes 6.00-16, 6-ply, at $22.40, to 14.00-24, 18-ply at $301.35, with proportionate prices on sizes between — issued 8-15, effective 8-20.

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**PERMIT NOT NECESSARY FOR INDUSTRIAL CONSTRUCTION — L-41, Direction 7** —Permit from WPB not necessary for industrial construction—issued 8-21.

**RELEASE OF CHEMICALS NOT NEEDED FOR ALLOCATED USES — General Allocation Order M-300, Direction 3**—Chemicals allocated to fill orders which are later cancelled may then be used without restriction to fill civilian orders—issued 8-21.

**MISCELLANEOUS CHEMICALS — Gen. Pref. Order M-340, as Amended 8-21-45** — Restriction removed which required a receiver of a subject chemical on a "preferred order" to use it only for the permitted (military) purposes specified in M-340—issued 8-21.

**INVENTORY LIMITATIONS REVOKED — CMP Reg. 2, Revocation**—Issued 8-28.

**MAKING OR DELIVERING MATERIAL EARLIER THAN REQUIRED BY CUSTOMERS — Pri. Reg. 1, Interp. 15, Revocation** — Superseded by Pri. Reg. 32, Interp. 3—issued 8-28.

**REVISED PRIORITIES SYSTEM — Priorities Regulation 29, as Amended 8-21-45** — Describes the accelerated transition to a simplified priorities system. The present system of ratings will be generally discontinued Sept. 30, 1945—issued 8-21.

**TELEPHONE SERVICE — Utilities Order U-2, as Amended 8-23-45** — Limitations on the availability of facilities for essential telephone uses eased, permitting installation of dial equipment to replace PBX systems—issued 8-23.

**UTILITIES ORDER U-7 REVOKED — Utilities Order U-7**—Natural gas restrictions revoked —issued 8-18.

### Office of Defense Transportation

**REGISTRATION OF EMPTY AND PARTIALLY LOADED TRUCKS NO LONGER REQUIRED — AO ODT 10, Revocation** — Issued 8-22, effective 11-1.

**SPECIAL PERMIT PROCEDURE RE-**




Cash in on these

PROFITABLE MARKETS!

AIRPORTS

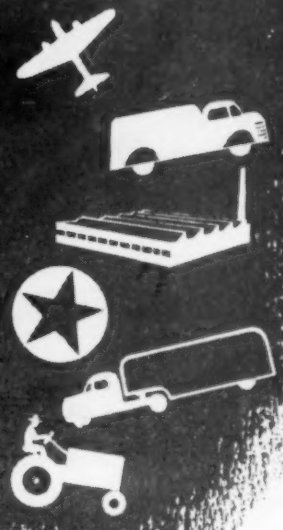
TRANSPORT TRUCKERS

INDUSTRIAL PLANTS

GOVERNMENT AGENCIES

COMMERCIAL FLEET OPERATORS

STATE AND COUNTY HIGHWAY DEPTS.



SELL them *Lubri-Gas* chemically processed oil for treating their motor fuels and reap the rewards of volume sales with steady repeat business. There are no OPA restrictions on Lubri-Gas processed fuel sold to these large motor unit operators.

Treating motor fuel with Lubri-Gas gives it PREMIUM PERFORMANCE—makes it ANTI-CARBON, ANTI-FRICTION, ANTI-GUM, ANTI-SLUDGE, ANTI-KNOCK FUEL. The regular use of Lubri-Gas Treated FUEL noticeably improves the pep, power, and performance of any motor. It oils the upper cylinder parts of the motor through fuel—frees sticky valves, prevents and removes carbon, reduces repair bills and saves fuel.

*Write us today for full information on how you can sell Lubri-Gas to volume motor fuel users.*

Registered Trademark

LUBRI-GAS LABORATORIES
221 No. LaSalle St.
Chicago 1, Illinois

**LUBRI-GAS**

*is Premium Plus because it is not only Anti-Knock, but also Anti-Friction, Anti-Carbon, Anti-Gum, Anti-Sludge.*

**Cleans and Lubricates as It Powers Your Motor**

COLUMBIAN
METAL SERVICE STATIONS

Expertly Pre-fabricated from STEEL

Fire-Safe and Termite-Proof

Will Not Rot, Warp, Shrink or Split

Whether your post-war marketing plans call for Super-service stations, with or without Lubritorium—large or small standard or specially designed units—Columbian will be ready to meet your requirements in a way that assures greatest efficiency and economy. WRITE for complete details.

COLUMBIAN STEEL TANK CO.
KANSAS CITY, MO.

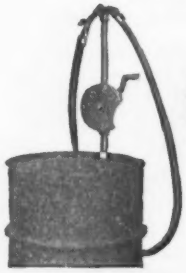
SERVING THE PETROLEUM INDUSTRY FOR 40 YEARS

BLACKMER ROTARY PUMPS

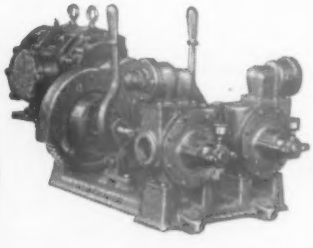
Write for Bulletin No. 102

PUMPS FOR THE PETROLEUM INDUSTRY

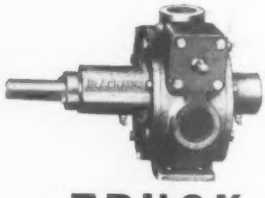
which explains why the "Bucket Design" (swinging vane principle) automatically compensates for wear and how the buckets, when finally worn out, are easily replaced and the pump restored to its normal capacity.



HAND PUMPS
1½ to 25 GPM
For barrel or tank service



BULK PUMPS
50 to 750 GPM
Single or twin



TRUCK PUMPS
35—50—90 GPM
Double Bearing

BLACKMER PUMP COMPANY
1880 Century Avenue
Grand Rapids 9, Mich.


## ----Oil Orders----

VOKED — AO ODT 14, Revocation — Procedure in applying for special permit relating to the operation of property carrying motor vehicles revoked — issued 8-22, effective 11-1.

COMMON MOTOR CARRIER RESTRICTIONS REVOKED — GO ODT 3, Revocation —Issued 8-22, effective 8-22 and 11-1.

LOCAL DELIVERY SERVICE RESTRICTIONS REVOKED—GO ODT 6A, Revocation —Issued 8-22, effective 8-22 and 11-1.

RESTRICTIONS ON CONTRACT AND PRIVATE MOTOR CARRIERS OF PROPERTY REVOKED — GO ODT 17, Revocation — Issued 8-22, effective 8-22 and 11-1.

## National War Labor Board

APPROVAL OF INCREASES IN COMPLIANCE WITH FAIR LABOR STANDARDS ACT — General Order 7, Amendment — Approval granted increases in accordance with fair labor standards act and in compliance with the various state statutes, promulgated prior to April 8, 1943. WLB approval required on increases after 4-8-43 if wage or salary rate exceeds minimum rate established by the Board—adopted 8-20.

BONUS PAYMENT NOT SUBJECT TO APPROVAL — NWLB General Order 10 — Payments to employees may be made without approval of NWLB, if such payments will not be used as basis for seeking increase in ceiling prices or of resisting justifiable reductions—adopted 8-20.

BONUS PAYMENT TO EMPLOYEES ENTERING ARMED FORCES — NWLB General Order 10-A — Bonus payments to employees entering armed forces do not require approval of NWLB, provided such payments will not be used as basis for seeking increase in price ceilings or for resisting justifiable price reductions —adopted 8-20.

APPROVAL NOT NECESSARY FOR ADJUSTMENTS EQUALIZING WAGES OF MALES AND FEMALES — NWLB General Order 16 — Adjustments equalizing wages of males and females for comparable quality and quantity of work on the same or similar operations and increases in accordance with this policy may be made without approval of NWLB, provided such increases will not be used as basis for seeking increase in price ceilings or of resisting justifiable reduction in prices—adopted 8-20.

CONTROLS NOT RELAXED OVER WAGES IN THE BUILDING AND CONSTRUCTION INDUSTRY — NWLB GO 41 — Controls not relaxed over wages in the building and construction industry, but wage adjustment board may correct inequities — adopted 8-22.

## Executive Orders

CONTINUED STABILIZATION OF THE NATIONAL ECONOMY DURING THE TRANSITION FROM WAR TO PEACE, AND MODIFICATION OF WARTIME CONTROLS OVER PRICES, WAGES, MATERIALS AND FACILITIES—Executive Order 9599 — Provides assistance to expanded production, continued stabilization of the national economy during transition from war to peace and for the orderly modification of wartime controls over prices, wages, materials and facilities — issued 8-18.

## Limits Antimony in Batteries

NPN News Bureau

WASHINGTON — Shortage of antimony, and not of lead, prompted WPB to amend its lead order today, to limit the antimonial lead that may be used for storage batteries to 9% antimony content. Exceptions to new rule are contracts for Army, Navy, Maritime Commission, and War Shipping Administration where an alloy with higher antimony content is a "must".

## Canada Removes Octane And Speed Limit Restrictions

*Special to NPN*

OTTAWA, Canada — The Dominion Government has removed all restrictions relative to the octane rating of gasoline sold to the public, and refining and distributing companies may now sell gasoline of any rating they wish. The war grades of gasoline were restricted to two ratings, the first 73-74 octane, and the second 66-70 octane. Prewar grading usually ran from 78-88 octane.

Price ceilings will remain on gasoline, but governmental control of speed has been lifted, and will be controlled by the provinces and municipalities.

## Coming Meetings

SEPTEMBER

**North Carolina Oil Jobbers Assn.**, Mayview Manor, Blowing Rock, N. C. Sept. 10-11.

**National Petroleum Assn.**, board of trustees, Hotel Claridge, Atlantic City N. J., Sept. 20-21.

**Michigan Petroleum Assn.**, fall convention, Park Hotel, Traverse City, Sept. 25-26.

OCTOBER

**American Assn. of Oilwell Drilling Contractors**, annual meeting, Skirvin Hotel, Oklahoma City, Oct. 1-2.

**Indiana Independent Petroleum Assn.**, Hotel Severin, Indianapolis, Oct. 10-11.

**Virginia Petroleum Jobbers Assn.**, Patrick Henry Hotel, Roanoke, Oct. 11 (tentative).

**California Natural Gasoline Assn.**, Biltmore Hotel, Los Angeles, Oct. 12.

**National Dixie Distributors Inc.**, Chicago, Oct. 15 (tentative).

**American Gas Association**, annual meeting, auditorium of the Engineering Societies Building, 29 West 39th Street, New York City, Oct. 24.

NOVEMBER

**Arkansas Independent Oil Marketers Assn.**, Albert Pike Hotel, Little Rock, Nov. 8.

**South Dakota Oil Men's Assn.**, fall convention, Watertown, S. D., Nov. 26-27. Tentative.

DECEMBER

**Oil Dealer's Assn. of Arkansas**, Dec. 6. (Location to be announced)

**Nebraska Petroleum Marketers' Assn.**, Hotel Paxton, Omaha, Dec. 4, 5, 6.

**Wisconsin Petroleum Marketers**, Dec. 11-12.

JANUARY

**Northwest Petroleum Assn.**, Jan. 24-25, Nicollet Hotel, Minneapolis, Minn.

FEBRUARY

**Kentucky Petroleum Marketers Assn.**, Louisville. (Place and date to be announced.)

**Iowa Independent Oil Jobber's Assn.**, Hotel Ft. Des Moines, Des Moines, Feb. 26-27 (tentative).

**Illinois Petroleum Marketers Assn.**, Peoria. (Exact date not yet set.)

APRIL

**Natural Gasoline Assn. of America**, annual convention, Baker Hotel, Dallas, Texas, April 17-18-19, 1946.

"Built better by KELLOGG-AMERICAN" is not just a phrase—it's a *reputation.* A reputation for leadership *earned* by over 35 years of experience in air compressor research, design engineering and precision manufacture. Earned by a record of performance in the field that is outstanding.

"Built better by KELLOGG-AMERICAN" means light wafer-type valves, roller wrist pin bearings, positive, controlled, force-feed lubrication and many other KELLOGG-AMERICAN engineered extras. It means smooth, quiet operation. More cubic feet of air per kilowatt hour. Volumetric efficiency is high. Operating costs are low. Compressor life is long and trouble-free. KELLOGG-AMERICAN means *more air per dollar.*

KELLOGG DIVISION
AMERICAN Brake Shoe COMPANY
ROCHESTER 9, N. Y. • LOS ANGELES 6, CALIF.
AIR COMPRESSORS • PAINT SPRAY EQUIPMENT

## Market Reports

**ATLANTIC COAST** — No price changes were reported throughout the week as suppliers reported "'sitting tight" awaiting the official OPA notice that would advise them of disposition of Dist. 1 revenue price increase, the reinstating (for 60 days) of the 3/10 of a cent increase granted fuel oil dealers and the restoration of the ⅛c per gal. increase for housebrand gasoline, in accordance with amendment 32 to MPR 88, effective Sept. 1.

Some suppliers and dealers said that they had kept their offices open Saturday with the expectation that the OPA order would be received in that day's mail. Others said that they were going ahead and transacting business in accordance with the new amendment.

**CALIFORNIA** — No price changes during the week, but changes are still expected. Consumption of gasoline is increasing as it has been since the lifting of rationing. The demand for the new specification gasolines is growing.

**GULF COAST**—Several refiners contacted said they were now in process of making higher octane gasoline and would be offering it in the open spot market within a few weeks. Premium, however, was reported a "little tight".

**MIDCONTINENT**—Grade 26-70 natural gasoline price dropped FOB Breckenridge August 29, to range of 3.875-4.125c when seller reported open spot sales of five cars at 3.875c; eight cars were reported sold at 4.125c. August 30, "over 10 cars" were reported sold at 3.875c and three cars at 4.125c, FOB. Breckenridge. The price went down again August 31, when seller reported open spot sales of five cars at 3.625c. Group 3 remained unchanged during the week with six cars reported sold at 4.5c.

Following open spot sales on refined products were reported: 2-3 cars 74 oct. gasoline at 5.875c, 3-4 cars 78-80 oct. Ethyl gasoline at 6.675c; one car range oil at 4c, for northern shipment, reported by Oklahoma refiner. Sales of four cars regular gasoline for shipment to Midwest in seller's cars at 5.875c by Oklahoma refiner. North Texas refiners reported open spot sale of 40 cars regular gasoline at 5.375c for immediate shipment to Dist. 1, 35 cars No. 2 fuel at 3.5c to Midwest in seller's cars, and 10 cars No. 3 fuel at 3.375c for northern shipment in seller's cars.

**MIDWEST**—Prices unchanged. Marketer reports that he is able to buy regular gasoline at 5.625 cents and premium at 6.625 cents in any quantity. Another marketer has lowered price on housebrand from 5.875c to 5.625c, dropped price on U.S.M. 60 or below from 5.125c to 5c and entered the open spot market with a quotation of 4c on range oil. Refiner not previously quoting premium gasoline on the open spot has entered a price of 6.75c. Michigan refiner not previously quoting U.G.I. gas oil has entered the market at 4.5c.

Reports on burning oils vary, some refiners saying they have plenty and others that they will need material.

Gasoline position in the Midwest for the most part is very good. Refiners say they have ample stocks but that demand is not as high as they expected with the lifting of rationing restrictions. Michigan refiners anticipate a month's extension in the normal vacation period. Stocks are reported low by all refiners in that area.

Refiner reports that bright stock movement has slowed down.

Penn Neutrals are still reported tight and there appears to be no immediate let-up.

**PENNSYLVANIA** — Markets unchanged last week. A gasoline shortage was reported in the Bradford-Warren area. Petrolatums, neutrals and bright stocks continued tight. One refiner said however, that had several cutbacks on government orders for lube oils.

### N.P.N. Gasoline Index

| | Dealer T.W. | Tank Car |
|---|---|---|
| | Cents Per Gal. | |
| Sept. 3 | 10.34 | 6.72 |
| Month ago | 10.34 | 6.72 |
| Year ago | 10.42 | 6.76 |

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

### Daily Av. Pennsylvania Crude Runs

*(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)*

| Week Ended Aug. 25, 1945 | Week Ended Aug. 18, 1945 | Week Ended Aug. 26, 1944 |
|---|---|---|
| 62,983 | 62,522 | 71,429 |

### CRUDE PRICES

Since changes in crude oil prices are few, the two pages of crude oil price tables are printed only when there are sufficient changes to warrant.

A record is kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers.

#### Crude Price Changes

*Standard Oil Co. (Indiana) announced prices for Rangely field, Rio Blanco County, Colorado (via pipeline only) beginning with Below 21 at $0.75 with 2c differential and ending with 40 & Above at $1.15. Effective Aug. 27, 1945.*

*For latest table of crude prices published see NPN Aug. 29, pages 56, 57 and 54.*

### Summary of Daily Gasoline Prices (August 27 to September 3)

| | Monday Sept. 3 | Friday August 31 | Thursday August 30 | Wednesday August 29 | Tuesday August 28 |
|---|---|---|---|---|---|
| **U. S. Motor (ASTM octane)** | | | | | |
| **76 octane Ethyl:** | | | | | |
| Oklahoma | 6.75 | 6.75 | 6.75 | 6.75 | 6.75 |
| Mid-Western (Group 3 basis) | 6.75 | 6.75 | 6.75 | 6.75 | 6.75 |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | ? | ? | ? | ? | ? |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | ? | ? (2) | 7 (2) | 7 (2) | 7 (2) |
| **70-74 octane:** | | | | | |
| Oklahoma | 5.875 | 5.875 | 5.875 | 5.875 | 5.875 |
| Mid-Western (Group 3 basis) | 5.875 | 5.875 | 5.875 | 5.875 | 5.875 |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.875 | 5.875 | 5.875 | 5.875 | 5.875 |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.875 | 5.875 | 5.875 | 5.875 | 5.875 |
| **63-66 octane:** | | | | | |
| Oklahoma | 5.625 (1) | 5.625 (1) | 5.625 (1) | 5.625 (1) | 5.625 (1) |
| Mid-Western (Group 3 basis) | 5.625 (2) | 5.625 (2) | 5.625 (2) | 5.625 (2) | 5.625 (2) |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.625 (1) | 5.625 (1) | 5.625 (1) | 5.625 (1) | 5.625 (1) |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.625 (2) | 5.625 (1) | 5.625 (1) | 5.625 (1) | 5.625 (1) |
| **60 octane & below:** | | | | | |
| Oklahoma | 5.25 | 5.25 | 5.25 | 5.25 | 5.25 |
| Mid-Western (Group 3 basis) | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.25 | 5.25 | 5.25 | 5.25 | 5.25 |
| **Motor Gasoline, 70-74 oct.** | | | | | |
| New York harbor | 9.075 | 9.075 | 9.075 | 9.075 | 9.075 |
| New York harbor, barges | 8.5 - 8.975 | 8.5 - 8.975 | - 8.975 | 8.5 - 8.975 | 8.5 - 8.975 |
| Philadelphia district | 9.075 | 9.075 | 9.075 | 9.075 | 9.075 |
| Baltimore district | 8.825 | 8.825 | 8.825 | 8.825 | 8.825 |
| **Motor Gasoline:** | | | | | |
| **Western Penna. Bradford-Warren:** | | | | | |
| "Q" Gasoline, Min. 70 Oct. (ASTM) | 7.625- 8.225 | 7.625- 8.225 | 7.625-8.225 | 7.625- 8.225 | 7.625- 8.225 |
| **Western Penna. Other Districts:** | | | | | |
| "Q" Gasoline, Min. 70 Oct. (ASTM) | 7.725 | 7.725 | 7.725 | 7.725 | 7.725 |

**Note: To conform with Article IV of MPR 88 as amended August 15 we are substituting 70-74 oct. ASTM for the old 72-74 oct. ASTM. We continue to include in this group, Housebrand quotations.**

# OIL PRICE SECTION

★

## At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from **Platt's** *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all *NPN-OILGRAM* offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

For complete price service delivered daily from nearest *OILGRAM* publishing office, New York, Cleveland and Tulsa, address Platt's Price Service, Inc., 1213 W. 3rd St., Cleveland (13), Ohio. Annual subscription rate payable in advance $100 per year train mail and $112.50 per year air mail.

## Refinery Prices

**Gasoline** —U. S. Motor (A S T M) except where otherwise specified.

| Prices in Effect | Sept. 3 | August 27 |
|---|---|---|
| **OKLAHOMA** | | |
| 76 oct. Ethyl... | 6.75 | 6.75 |
| 70-74 oct..... | 5.875 | 5.875 |
| 63-66 oct..... | 5.625 (1) | 5.625 (1) |
| 60 oct. & below. | 5.25 | 5.25 |
| **MID-WESTERN** (Group 3 basis) | | |
| 76 oct. Ethyl... | 6.75 | 6.75 |
| 70-74 oct..... | 5.875 | 5.875 |
| 63-66 oct..... | 5.625 (2) | 5.625 (2) |
| 60 oct. & below. | 5.2 – 5.25 | 5.2 – 5.25 |
| **N. TEX.** (For shpt. to Tex. & N. M. dest'ns.) | | |
| 76 oct. Ethyl... | 7 | 7 |
| 70-74 oct..... | 5.875 | 5.875 |
| 63-66 oct..... | 5.625 (1) | 5.625 (1) |
| 60 oct. & below. | 5.2 – 5.25 | 5.2 – 5.25 |
| **W. TEX.** (For shpt. to Tex. & N. M. dest'ns.) | | |
| 76 oct. Ethyl... | 7 | 7 |
| 70-74 oct..... | 5.875 | 5.875 |
| 63-66 oct..... | 5.625 (2) | 5.625 (2) |
| 60 oct. & below. | 5.25 | 5.25 |
| **CENT. W. TEX.** (Prices to truck transports) | | |
| 76 oct..... | 6.875–7 (2) | 6.875–7 (2) |
| 70-74 oct..... | 5.875 (2) | 5.875 (2) |
| 67-69 oct..... | .... | .... |
| 62 oct. & below. | 5.25 (2) | 5.25 (2) |
| **KANSAS** (For Kansas destinations only) | | |
| 76 oct. Ethyl... | 7.2 – 7.3 | 7.2 – 7.3 |
| 70-74 oct..... | 6.2 | 6.2 |
| 63-66 oct..... | 5.9 (2) | 5.9 (2) |
| 60 oct. & below. | 5.5 | 5.5 |
| **ARK.** (For shipment to Ark. & La.) | | |
| 76 oct. Ethyl... | 7 (1) | 7 (1) |
| 70-74 oct..... | 5.875 (1) | 5.875 (1) |
| 62 oct. " | .... | .... |
| 60 oct. & below, unleaded..... | 5.25 (1) | 5.25 (1) |
| **WESTERN PENNA.** (Motor gasoline) | | |
| *Bradford-Warren*: | | |
| "Q" Gasoline Min. 70 Oct. (ASTM) | 7.625-8.225(a) | 7.625-8.225(a) |
| *Other districts*: "Q" Gasoline, Min. 70 Oct. (ASTM) | 7.725 | 7.725 |

(a) Highs and lows for Schedule D area, in MPR 88 and outside Schedule D area, respectively.

| Prices in Effect | Sept. 3 | August 27 |
|---|---|---|
| **CENTRAL MICHIGAN** (FOB Central Mich. refinery group basis; shpts. may originate at plants outside Central group.) | | |
| U.S. Motor: (Oct. ASTM): | | |
| 70-74 oct..... | 7.50–8.125 | 7.50–8.125 |
| 75-76 oct..... | 9–9.25 (2) | 9–9.25 (2) |
| Str. run gasoline, excluding Detroit shpt..... | 6 | 6 |
| **OHIO** (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances). | | |
| 70-74 oct..... | 8.25 | 8.25 |
| **CALIFORNIA** U.S. Motor: | | |
| 76 oct. (Ethyl)... | 8 – 8.5 | 8 – 8.75 |
| 70-74 oct..... | 7 – 7.5 | 7 – 7.5 |
| 65 oct. & below (3rd grade)..... | 5.75 (1) | 5.75 (1) |

## Kerosine, & Gas Fuel Oils

| | | |
|---|---|---|
| **OKLAHOMA** | | |
| 41-43 grav. w.w... | 4.375 | 4.375 |
| 42-44 grav. w.w... | 4.5 | 4.5 |
| Range oil..... | 4 | 4 |
| No. 1 p.w..... | 3.875 | 3.875 |
| No. 1 straw..... | .... | .... |
| No. 2 straw..... | 3.625 | 3.625 |
| No. 3 fuel..... | 3.5 | 3.5 |
| No. 6 fuel..... | $0.90–$0.97 | $0.90–$0.97 |
| U. G. I. Gas Oil.. | ..... | ..... |
| 14-16 fuel..... | $0.97 (1) | $0.97 (1) |
| **MID-WESTERN** (Group 3 basis) | | |
| 41-43 grav. w.w... | 4.375 | 4.375 |
| 42-44 grav. w.w... | 4.5 | 4.5 |
| Range Oil..... | 4 –4.1 | 4 –4.1 |
| No. 1 p.w..... | 3.875 | 3.875 |
| No. 2 straw..... | 3.625 | 3.625 |
| No. 3..... | 3.5(1) | 3.5 |
| No. 5..... | .... | .... |
| No. 6..... | $0.97 (1) | $0.97 (1) |
| **N. TEX.** (For shpt. to Tex. & N. M. dest'ns.) | | |
| 41-43 grav. w.w... | 4.375 | 4.375 |
| 42-44 grav. w.w... | 4.5 (1) | 4.5 (1) |
| No. 1 p.w..... | 3.875 (1) | 3.875 (1) |
| No. 6 fuel..... | $0.97 (1) | $0.97 (1) |
| **W. TEX.** | | |
| No. 6 fuel..... | $0.97 (1) | $0.97 (1) |
| **AMARILLO, TEX.** (For shpt. to W. Okla. & Tex. differential territory.) | | |
| 42-44 grav. w.w... | 4.5 (1) | 4.5 (1) |
| **KANSAS** (For Kansas destinations only). | | |
| 41-43 grav. w.w... | No Price | No Price |
| 42-44 grav. w.w... | 4.7 | 4.7 |
| No. 1 p.w..... | 4.1 | 4.1 |
| No. 6 fuel..... | $0.95–$1.02 | $0.95–$1.02 |
| **ARK.** (For shipment to Ark. and La.) | | |
| 41-43 grav. w.w... | .... | .... |
| 42-44 w.w. kero... | 4.5 (1) | 4.5 (1) |
| No. 1..... | .... | .... |
| No. 2..... | 3.625 (1) | 3.625 (1) |
| No. 3 fuel..... | 3.5 (1) | 3.5 (1) |
| Tractor fuel, for shpt. to Ark. points only..... | 5.125 (1) | 5.125 (1) |
| Diesel fuel 52 & below..... | 4 (1) | 4 (1) |
| Diesel fuel 58 & above..... | 4.25 (1) | 4.25 (1) |
| **WESTERN PENNA.** | | |
| *Bradford-Warren*: | | |
| 45 grav. w.w..... | 6.5 – 7.55 | 6.5 – 7.55 |
| 46 grav. w.w..... | .... | .... |
| No. 1 fuel..... | 6.75(1&b) | 6.75(1&b) |
| No. 2 " ... | 6.125-7.125(2&b) | 6.125-7.125(2&b) |
| No. 3 " .... | 6.25-7.25(1&b) | 6.25-7.25(1&b) |
| 36-40 gravity..... | 6.625-6.75(2) | 6.625-6.75(2) |

(b) Highs and lows for Schedule D area, in MPR 88 and outside Schedule D area, respectively.

| | | |
|---|---|---|
| *Other districts*: | | |
| 45 grav. w.w..... | 7 – 7.425 | 7 – 7.425 |
| 46 grav. w.w..... | 7.125– 7.375 | 7.125– 7.375 |
| 47 grav. w.w..... | 7.375– 7.50 | 7.375– 7.50 |
| No. 1 fuel..... | 6.875– 7.175 | 6.875– 7.175 |
| No. 2 " ..... | 6.75 – 6.875 | 6.75 – 6.875 |
| No. 3 " ..... | 6.75 | 6.75 |
| 36-40 grav. Pittsburgh dist. prices excluded..... | 6.625– 6.875 | 6.625– 6.875 |
| **CENTRAL MICHIGAN** (FOB Central Mich. refinery group basis; shpts. may originate at plants outside Central group.) | | |
| 46-49 gravity w.w. | 5.8 – 6 | 5.8 – 6 |
| P.W. Distillate... | 5.5 | 5.5 |
| No. 3 gas. oil, Straw | 5 | 5 |
| U.G.I. gas oil..... | 4.5 | 4.5 (2) |
| **Fuel Oils** (*Vis. at* 100). | | |
| 300-500 Vis..... | 4.14 | 4.14 |
| 100-300 Vis..... | 4.5 | 4.5 |
| **OHIO** (S. O. quotations for statewide delivery) | | |
| Kerosine..... | " | " |

| Prices in Effect | Sept. 3 | August 27 |
|---|---|---|
| **CALIFORNIA** | | |
| 40-43 grav. w.w... | ?(1) | ? |
| *San Joaquin Valley*: | | |
| Heavy fuel..... | $1.10 (2) | $1.10 (2) |
| Light fuel..... | $1.20 (1) | $1.20 (1) |
| Diesel fuel..... | 4 (2) | 4 (2) |
| Stove dist..... | 5 (2) | 5 (2) |
| *Los Angeles*: | | |
| Heavy fuel..... | $1.10 (2) | $1.10 (2) |
| Light fuel..... | $1.20 (1) | $1.20 (1) |
| Diesel fuel..... | 3.25 – 4 (2) | 3.25 – 4 (2) |
| Stove dist..... | 5 (1) | 5 (1) |
| *San Francisco*: | | |
| Heavy fuel..... | $1.15 (1) | $1.15 (1) |
| Light fuel..... | $1.25 (1) | $1.25 (1) |
| Diesel fuel..... | 4.5 (1) | 4.5 (1) |
| Stove dist..... | 5.5 (1) | 5.5 (1) |

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

## Lubricating Oils

| Prices in Effect | Sept. 3 | August 27 |
|---|---|---|
| **WESTERN PENNA.** Prices are for sales made, or offers reliably reported, to jobbers & compounders only. | | |
| **Viscous Neutrals**— *No. 3 col Vis. at* 70°*F.* | | |
| 200 Vis. (180 at 100°) 420-425 fl. | | |
| 0 p.t..... | 38 (1) | 38 (1) |
| 10 p.t..... | 37 (1) | 37 (1) |
| 15 p.t..... | 36 (1) | 36 (1) |
| 25 p.t..... | 28–33 | 28–33 |
| 150 Vis. (143 at 100°) 400-405 fl. | | |
| 0 p.t..... | 36 (1) | 36 (1) |
| 10 p.t..... | 35 (1) | 35 (1) |
| 15 p.t..... | 34 (1) | 34 (1) |
| 25 p.t..... | 26–31 | 26–31 |

NOTE: Limited quantity neutrals available to regular trade.

| | | |
|---|---|---|
| **Cylinder Stocks:** | | |
| *Brt. stk.*, 145-155 *vis. at* 210°, 540-550 fl., *No. 3 col.* | | |
| 10 p.t..... | 30.5 (1) | 30.5 (1) |
| 15 p.t..... | 29.5 (1) | 29.5 (1) |
| 25 p.t..... | 25 | 25 |
| 600 S.R. filterable | 15 | 15 |
| 650 S.R..... | 15.5 | 15.5 |
| 600 fl..... | 16 | 16 |
| 630 fl..... | 17 | 17 |

| | | |
|---|---|---|
| **MID-CONTINENT** (F. o. b. Tulsa) | | |
| Neutral Oils (*Vis. at* 100° *F. 0 to* 10 *P.P.*) | | |
| **Pale Oils:** | | |
| **Vis. Color** | | |
| 60-85—No. 2.... | 7.5 | 7.5 |
| 86-110—No. 2... | 7.5 | 7.5 |
| 150—No. 3..... | 11 –11.5 | 11 –11.5 |
| 180—No. 3..... | 11.5 –15 | 11.5 –15 |
| 200—No. 3..... | 12 –15 | 12 –15 |
| 250—No. 3..... | 14 –16.5 | 14 –16.5 |
| 280—No. 3..... | 15 | 15 |
| 300—No. 3..... | 16 (2) | 16(2) |
| **Red Oils:** | | |
| 180—No. 5..... | 11.5 (1) | 11.5 (1) |
| 200—No. 5..... | 12 (1) | 12 (1) |
| 280—No. 5..... | No Price | No Price |
| 300—No. 5..... | 16–17.5 (2) | 16–17.5 (2) |
| **Bright Stock**—*Vis. at* 210° | | |
| 200 Vis. D..... | 27 (1) | 27 (1) |
| 150-160 Vis. D: | | |
| 0 to 10 p.p..... | 23 | 23 |
| 10 to 25 p.p..... | 22.5–23 | 22.5–23 |
| 25 to 40 p.p..... | 23 (1) | 23 (1) |
| 150-160 Vis. E.... | 22 (1) | 22 (1) |
| 120 Vis. D: | | |
| 0 to 10 p.p..... | 22 (2) | 22 (2) |
| 600 S.R. Dark Green..... | 8.5 (1) | 8.5 (1) |
| 600 S.R. Olive Green..... | 10-11 (2) | 10-11 (2) |
| 631 S.R..... | .... | .... |
| Black Oil..... | .... | .... |

| | | |
|---|---|---|
| **SOUTH TEXAS** (Neutral Oils) | | |
| **Pale Oils** (*Vis. at* 100°*F.*) | | |
| **Vis. Color** | | |
| 100 No. 1½-2½. | 6.5 | 6.5 |
| 200 No. 2-3..... | 8.75 | 8.75 |
| 300 No. 2-3..... | 9.25 | 9.25 |
| 500 No. 2½-3½. | 10 | 10 |
| 750 No. 3-4..... | 10.25 | 10.25 |
| 1200 No. 3-4..... | 10.375 | 10.375 |
| 2000 No. 4..... | 10.5 | 10.5 |

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

*NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown have reported in market leads.*

## Refinery Prices (Continued)

| Prices in Effect | Sept. 3 | August 27 |
|---|---|---|
| **Red Oils:** | | |
| 100 No. 5-6 | 6.5 (2) | 6.5 (2) |
| 200 No. 5-6 | 8.75 | 8.75 |
| 300 No. 5-6 | 9.25 | 9.25 |
| 500 No. 5-6 | 10 | 10 |
| 750 No. 5-6 | 10.25 | 10.25 |
| 1200 No. 5-6 | 10.375 | 10.375 |
| 2000 No. 5-6 | 10.5 | 10.5 |

**CHICAGO** (From Mid-Continent p.l. crude.) Neutral oils *vis. at* 100° *F.* 0 *to* 10 *p.p.*

| Pale Oils Vis. Color | | |
|---|---|---|
| 60-85—No. 2 | 9 (1) | 9 (1) |
| 86-110—No. 2 | 9.25 (1) | 9.25 (1) |
| 150—No. 3 | 12.5 (1) | 12.5 (1) |
| 180—No. 3 | 13 (1) | 13 (1) |
| 200—No. 3 | 13 (1) | 13 (1) |
| 250—No. 3 | 14 (1) | 14 (1) |
| **Red Oils:** | | |
| 180—No. 5 | 13 (1) | 13 (1) |
| 200—No. 5 | 13 (1) | 13 (1) |
| 250—No. 5 | 14 (1) | 14 (1) |
| 280—No. 5 | 15 (1) | 15 (1) |
| 300—No. 5 | 15.5 (1) | 15.5 (1) |

**Note:** Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

| **Unfiltered Steam Refined** (*Viscosity at* 210°) | | |
|---|---|---|
| 140 | 11.5 (1) | 11.5 (1) |
| 160 | 12.5 (1) | 12.5 (1) |
| 200 | 13.5 (1) | 13.5 (1) |

| **Bright stocks,** 160 *vis. at* 210 *No.* 8 *color:* | | |
|---|---|---|
| 0 to 10 p.p. | 24 (1) | 24 (1) |
| 15 to 25 p.p. | 23.5 (1) | 23.5 (1) |
| 30 to 40 p.p. | 21.5 (1) | 21.5 (1) |
| E filtered Cyl. Stock | 15.5 (1) | 15.5 (1) |

**Note:** To obtain prices delivered in Chicago add 0.25c per gal.

## Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

**FOB GROUP 3**

Grade 26-70..... 4.5 (Sales) 4.5 (Quotes)

**FOB BRECKENRIDGE**

Grade 26-70..... 3.5 (Sales) 4.125(Quotes)

**CALIFORNIA** (FOB plants in Los Angeles basin)

21 pound vapor pressure for blending.... 4.75 - 5.375 4.75 - 5.375

## Naphtha and Solvent

(*FOB Group* 3)

| | | |
|---|---|---|
| Stoddard solvent.. | 6.625 | 6.625 |
| Cleaners' naphtha. | 7.125 | 7.125 |
| V.M.&P. naphtha | 7.1 - 7.125 | 7.1 - 7.125 |
| Mineral spirits... | 6.1 - 6.125 | 6.1 - 6.125 |
| Rubber solvent... | 7.1 - 7.125 | 7.1 - 7.125 |
| Lacquer diluent... | 7.375- 8.125 | 7.375- 8.125 |
| Benzol Diluent... | 7.875-8.625 | 7.875- 8.625 |

**WESTERN PENNA.**

| *Other Districts:* | | |
|---|---|---|
| Untreated naphtha | 7 -7.25 (2) | 7 -7.25 (2) |
| Stoddard solvent.. | 7.25 -7.5 | 7.25 -7.5 |

**OHIO** (S. O. quotations for statewide delivery:)

| V.M.&P. naphtha. | D.C. naphtha, | Varnolene & |
|---|---|---|
| Sohio solvent..... | 10 | 10 |
| Rubber solvent... | 9 | 9 |

## Wax

**WESTERN PENNA.** (Bbls. C.L.)
**White Crude Scale:**

| | | |
|---|---|---|
| 122-124 A.m.p.... | 4.25 (2) | 4.25 (2) |
| 124-126 A.m.p.... | 4.25 | 4.25 |

**MID-CONTINENT** (C.L. FOB Refinery)

**Semi-refined:**

| | | |
|---|---|---|
| 128 AMP min., white, 50 kilo bags.... | No Price | No Price |
| 132-134 AMP, bbls..... | 5.25 (1) | 5.25 (1) |

**CHICAGO** (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose, 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

| **Fully refined:** | | |
|---|---|---|
| 122-124 (bags only) | 5.6 | 5.6 |
| 125-127 | 6 | 6 |
| 127-129 | 6.25 | 6.25 |
| 130-132 | 6.55 | 6.55 |
| 132-134 | 6.8 | 6.8 |
| 135-137 | 7.55 | 7.55 |

## Petrolatums

**WESTERN PENNA.** (Bbls., carloads: tank cars, 0.5c per lb. less.)

| | | |
|---|---|---|
| Snow White..... | 6.125- 7.25 | 6.125- 7.25 |
| Lily White..... | 5.375- 6.25 | 5.375- 6.25 |
| Cream White..... | 4.375- 5.5 | 4.375- 5.5 |
| Light Amber..... | 3.375- 4 | 3.375- 4 |
| Amber..... | 3.125- 3.75 | 3.125- 3.75 |
| Red..... | 3 - 3.5 | 3 - 3.5 |

## Tank Wagon Prices

*Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline* do not include taxes; *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect Sept. 3, 1945 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

**S. O. N. J.**

| | Esso (*Regular Grade*) Consumer Tank Wagon | Dealer T.W. | Gasoline Taxes | Kerosine T.W. |
|---|---|---|---|---|
| *Atlantic City, N. J. | 10.2 | 10.7 | 4.5 | 10.00 |
| *Newark | 10.2 | 10.7 | 4.5 | 10.00 |
| Annapolis, Md. | 10.55 | 11.05 | 5.5 | ..... |
| Baltimore | 9.95 | 10.45 | 5.5 | 10.8 |
| Cumberland | 11.35 | 11.85 | 5.5 | 12.3 |
| Washington, D. C. | 10.20 | 10.7 | 4.5 | 11.3 |
| Danville, Va | 11.65 | 12.15 | 6.5 | 11.55 |
| Petersburg | 10.75 | 11.25 | 6.5 | 12.3 |
| Norfolk | 10.45 | 10.95 | 6.5 | 11.3 |
| Richmond | 10.75 | 11.25 | 6.5 | 12.3 |
| Roanoke | 11.95 | 12.45 | 6.5 | 11.8 |
| Charleston, W. Va. | 11.65 | 12.15 | 6.5 | 13.1 |
| Parkersburg | 10.95 | 11.45 | 6.5 | 12.8 |
| Wheeling | 10.95 | 11.45 | 6.5 | 13.4 |
| Charlotte, N. C. | 11.7 | 12.20 | 7.5 | 10.3 |
| Hickory | 12.25 | 12.75 | 7.5 | 11.3 |
| Mt. Airy | 12.1 | 12.6 | 7.5 | 10.5 |
| Raleigh | 11.45 | 11.95 | 7.5 | 11.3 |
| Salisbury | 11.75 | 12.25 | 7.5 | 11.7 |
| Charleston, S. C. | 10.55 | 11.05 | 7.5 | ..... |
| Columbia | 11.4 | 11.9 | 7.5 | ..... |
| Spartanburg | 12.1 | 12.6 | 7.5 | ..... |
| New Orleans, La. | 8.75 | 9.25 | 8.5 | **8.00 |
| Baton Rouge | 8.75 | 9.25 | 8.5 | **8.5 |
| Alexandria | 8.75 | 9.25 | 8.5 | **8.5 |
| Lake Charles | 9.00 | 9.5 | 8.5 | **10.00 |
| Shreveport | 8.5 | 9.00 | 8.5 | **7.00 |
| Knoxville, Tenn. | 10.5 | 11.00 | 8.5 | 10.5 |
| Memphis | 8.9 | 9.4 | 8.5 | 8.5 |
| Chattanooga | 10.5 | 11.00 | 8.5 | 9.00 |
| Nashville | 10.5 | 11.00 | 8.5 | 8.00 |
| Bristol | 9.75 | 10.25 | 8.5 | 10.00 |
| Little Rock, Ark. | 9.5 | 10.00 | 8.0 | 10.00 |
| Lafayette, La. | 9.0 | 9.50 | 8.5 | **8.00 |

| | Mineral Spirits T.W. | V.M.&P. T.W. |
|---|---|---|
| Newark, N. J. | 13 | 14.5 |
| Baltimore, Md. | 15.5 | .... |
| Washington, D. C. | 15.5 | .... |

| Fuel Oils—T.W. | No. 1 | No. 2 | No. 3 |
|---|---|---|---|
| Atlantic City, N. J. | 10 | 9 | 9 |
| Newark | 10 | 9 | 9 |
| Annapolis, Md. | .. | .. | .. |
| Baltimore | 9.8 | 9 | 9 |
| Washington, D. C. | 10.3 | 9.4 | 9.4 |
| Norfolk, Va | 10 | 8.8 | 8.8 |
| Petersburg | 10.3 | 9 | .. |
| Richmond | 10.3 | 9 | 9 |
| Charlotte, N. C. | 10.3 | 10.1 | .. |
| Hickory, N. C. | .. | 9.7 | .. |
| Raleigh | 11.3 | 9.8 | .. |
| Charleston, S. C. | .. | 8.7 | .. |
| Columbia | .. | 9.7 | .. |
| Spartanburg | .. | 10.5 | .. |

*Effective Aug. 5, '42 minimum retail resale price of 14.2c posted thru New Jersey. Discounts:

**Includes 1.0c per gallon State Tax.

*Effective Nov. 7, 1944, the discount for kerosine in the State of Virginia was eliminated, the discount in Tennessee was eliminated May 1, 1945 and the discount in Louisiana was eliminated May 7, 1945.

Undivided Dealers at Dealer Tank Wagon price less 0.5c per gallon for Esso Gasoline.

*Esso gasoline*—to undivided dealers, 0.5c off dealer t.w.

*Kerosine*—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey, Virginia, Tennessee and Louisiana.

*Naphtha*—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

## Notice

These prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Miss. 1/50c; Neb. 3/100c; Nev. 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/20c; Tenn. 2/5c; and Wisc. 3/100c.

Kerosine inspection fees only: Ala. 1/2c; Fla. 1/8c; Iowa 3/50c; Mich. 1/5c per gal.

**CONTI OIL**

| | Conoco Bronze (*3rd Grade*) †Tank Wagon | Demand | Gasoline Taxes | Kerosine T.W. |
|---|---|---|---|---|
| Denver, Col. | 10 | 9 | 5.5 | 10 |
| Grand Junc., Col. | 12.5 | 11.5 | 5.5 | 12.5 |
| Pueblo, Col. | 9.5 | 8.5 | 5.5 | 9.5 |
| Casper, Wyo. | 11.5 | 10.5 | 5.5 | 12 |
| Cheyenne, Wyo. | 10 | 9 | 5.5 | 9 |
| Billings, Mont. | 12 | 11 | 6.5 | 12.5 |
| Butte, Mont. | 11.5 | 10.5 | 6.5 | 13.5 |
| Great Falls, Mont. | 12 | 11 | 6.5 | 12.5 |
| Helena, Mont. | 12 | 11 | 6.5 | 13 |
| Salt Lake City, Utah | 13.5 | 12.5 | 5.5 | 14.5 |
| Twin Falls, Ida. | 14.5 | 13.5 | 7.5 | 14 |
| Albuquerque, N. M. | 10.5 | 9.5 | *7 | 9.5 |
| Roswell, N. M. | 10 | 9 | *7 | 7 |
| Santa Fe, N. M. | 10.5 | 9.5 | *7.5 | 10 |
| Ft. Smith, Ark. | 9 | 6.25 | 8 | 8 |
| Texarkana, Ark. | 9 | 7.5 | *5.5 | 7 |
| Muskogee, Okla. | 7.75 | 6.75 | 9 | 8 |
| Oklahoma City, Okla. | 8 | 7 | 9 | 8 |
| Tulsa, Okla. | 8 | 7 | 9 | 8 |

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.

†To consumers & Dealers.

NOTE: Current selling price—where this is lower than maximum price it is because of local competition. It is the actual selling price and is subject to revision due to delays in receiving information from the field.

Arkansas tax 8c applies at Ft. Smith.

**Standard Gasoline** (*Regular Grade*)
**Flight Gasoline** (*Third Grade*)

**S. O. CAL.**

| | Standard Posted Net Tank Truck | Standard Posted Retail | Flight Posted Net Tank Truck | Flight Posted Retail | Gasoline Taxes |
|---|---|---|---|---|---|
| San Francisco, Cal. | 10 | 14 | 9 | 12 | 4.5 |
| Los Angeles, Cal. | 9.5 | 13.5 | 8.5 | 11.5 | 4.5 |
| Fresno, Cal. | 11 | 15 | 10 | 13 | 4.5 |
| Phoenix, Ariz. | 12 | 16 | 10 | 13 | 6.5 |
| Reno, Nev. | 12 | 16 | 11 | 14 | 5.5 |
| Portland, Ore. | 10.5 | 14.5 | 9.5 | 12.5 | 6.5 |
| Seattle, Wash. | 10.5 | 14.5 | 9.5 | 12.5 | 6.5 |
| Spokane, Wash. | 12.5 | 16.5 | 11.5 | 14.5 | 6.5 |
| Tacoma, Wash. | 10.5 | 14.5 | 9.5 | 12.5 | 6.5 |
| Boise, Ida. | 13.5 | 17.5 | 12.5 | 15.5 | 7.5 |

***Chevron Aviation 73**

| | Posted Net Tank Truck | Gasoline Taxes | Kerosine Tank Truck |
|---|---|---|---|
| San Francisco, Cal. | 12.5 | 4.5 | 11.5 |
| Los Angeles, Cal. | 12 | 4.5 | 10 |
| Fresno, Cal. | 13.5 | 4.5 | 12.5 |
| Phoenix, Ariz. | 14.5 | 6.5 | 12.5 |
| Reno, Nev. | 14.5 | 5.5 | 13.5 |
| Portland, Ore. | 13 | 6.5 | **13.5 |
| Seattle, Wash. | 13 | 6.5 | **13.5 |
| Spokane, Wash. | 16 | 6.5 | **16.5 |
| Tacoma, Wash. | 13 | 6.5 | **13.5 |
| Boise, Ida. | 18 | 4.0 | **16.5 |

Resale and Commercial Gasoline: Tank car deliveries of Chevron Aviation 73, Standard's Supreme and Flight Gasoline .25c per gal. below posted net tank truck price. Tank car deliveries of Standard Gasoline .375c per gal. below posted net tank truck price. Pearl Oil (The Standard Kerosene) Tank car deliveries 3c below posted tank truck price.

*Formerly Standard Aviation 73.
**Effective August 22, 1945.

**TEXAS CO.**

| | Gasoline—Dealer T.W. Fire-Chief (Regular) | Indian (*3rd Grade*) | Gasoline Taxes |
|---|---|---|---|
| Dallas, Tex. | 7.5 | 6.5 | 5.5 |
| Ft. Worth, Tex. | 7.5 | 6.5 | 5.5 |
| Wichita Falls, Tex. | 8.5 | 7.5 | 5.5 |
| Amarillo, Tex. | 8.5 | 7.5 | 5.5 |
| Tyler, Tex. | 8.5 | 7.5 | 5.5 |
| El Paso, Tex. | 11 | 10.5 | 5.5 |
| San Angelo, Tex. | 8.5 | 7.5 | 5.5 |
| Waco, Tex. | 8.5* | 7* | 5.5 |
| Austin, Tex. | 8.5 | 7.5 | 5.5 |
| Houston, Tex. | 8.5 | 7.5 | 5.5 |
| San Antonio, Tex. | 8.5 | 7.5 | 5.5 |
| Port Arthur, Tex. | 8.5 | 7.5 | 5.5 |

*Less 1c temporary allowance to all dealers

(Continued on next page)

## Tank Wagon Prices—Continued

### S. O. IND.

| | Red Crown Blue Crown Cons. T.W. | (Regular Grade) Red Crown | Blue Crown | Gaso-line Taxes | (Third Grade) Kero-sine T.W. |
|---|---|---|---|---|---|
| | *Red Dealer Prices | | | | |
| Chicago, Ill. | 11.6 | 9.6 | 9.1 | 4.5 | 10.3 |
| Decatur, Ill. | 11.6 | 9.6 | 8.7 | 4.5 | 10 |
| Joliet, Ill. | 11.9 | 10.3 | 9.2 | 4.5 | 10.3 |
| Peoria, Ill. | 11.7 | 9.9 | 9.7 | 4.5 | 10.1 |
| Indianapolis, Ind. | 11.6 | 10.1 | 9.6 | 5.5 | 9.8 |
| Evansville, Ind. | 11.4 | 9.9 | 8.6 | 5.5 | 9.6 |
| South Bend, Ind. | 12 | 10.5 | 10 | 5.5 | 10.2 |
| Detroit, Mich. | 11.4 | 9.9 | ... | 4.5 | 9.7 |
| Grand Rapids, Mich. | 11.4 | 9.9 | ... | 4.5 | 9.6 |
| Saginaw, Mich. | 11.4 | 9.9 | ... | 4.5 | 9.6 |
| Green Bay, Wis. | 12.2 | 10.7 | 10.2 | 5.5 | 10.6 |
| Milwaukee, Wis. | 12.1 | 10.6 | 10.1 | 5.5 | 10.5 |
| La Crosse, Wis. | 11.9 | 10.4 | 9.9 | 5.5 | 10.3 |
| Minneapolis - St. Paul | 11.9 | 10.4 | 9.9 | 5.5 | 10.3 |
| Duluth, Minn. | 12.2 | 10.7 | .... | 5.5 | 10.6 |
| Mankato, Minn. | 11.9 | 10.4 | 9.9 | 5.5 | 10.3 |
| Des Moines, Ia. | 11.4 | 9.9 | 9.4 | 5.5 | *9.8 |
| Mason City, Ia. | 11.7 | 10.2 | 9.7 | 5.5 | *10.1 |
| St. Louis, Mo. | 11.0 | 9.5 | 9.3 | *4.5 | 9.8 |
| Kansas City, Mo. | 11.0 | 9.5 | 8.6 | *4.5 | 9.4 |
| St. Joseph, Mo. | 11.2 | 9.7 | 9.2 | *4.5 | 9.6 |
| Fargo, N. D. | 12.9 | 11.4 | 10.9 | 5.5 | 11.3 |
| Huron, S. D. | 12.3 | 10.8 | 10.3 | 5.5 | 10.7 |
| Wichita, Kans. | 10.3 | 8.8 | 7.2 | 4.5 | 8.7 |
| Omaha, Neb. | 11.4 | 9.6 | 9.4 | 6.5 | 9.8 |

| | Oleum Spirits | V.M.&P. Naphtha | Stani-sol | *Taxes |
|---|---|---|---|---|
| | (Prices are base prices before discounts) | | | |
| Chicago | 13.5 | 13.8 | 12.8 | 4.5 |
| Detroit | 15.8 | 15 | 16.3 | 4.5 |
| K. C., Mo. | 13.3 | 14.3 | 13.8 | 1.5 |
| St. Louis, Mo. | 13.7 | 14.7 | 13.2 | 1.5 |
| Milwaukee | 14.4 | 15.4 | 14.9 | 5.5 |
| Minneap'ls | 14.2 | 15.2 | 13.5 | 5.5 |

| | Fuel Oils T.W. Chicago Standard Heater Oil | Stanolex Furnace Oil |
|---|---|---|
| 1-99 gals. | 9.0 | 8.5 |
| 100-149 gals. | 8.0 | 7.5 |
| 150 gals. & over | 7.5 | ... |
| 150-399 gals. | ... | 7.5 |
| 400 gals. & over | ... | 7.0 |

| | Stanolex Fuel A | Stanolex Fuel C |
|---|---|---|
| 1-749 gals. | 6.2 | 5.7 |
| 750 gals. & over | 5.45 | 4.95 |

Stanolex Furnace Oil

| Other Points | 1-99 gals. | 100 gals. X over |
|---|---|---|
| Indianapolis | 8.7 | 7.7 |
| Detroit | 8.4 | 7.4 |
| Milwaukee | 8.7 | 7.7 |
| Minneapolis | 8.8 | 7.8 |
| St. Louis | 8.1 | 7.1 |
| Kansas City | 7.8 | 6.8 |

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 3c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

Effective August 20, 1945.

### S. O. OHIO

| | *Sohio X-70 Gasoline (Regular Grade) Con-sumer T.W. | **Re-sel-lers | ‡S.S. | Gaso-line Taxes | †Kero-sine T.W. |
|---|---|---|---|---|---|
| Ohio, Statewide | 12 | 10 | 13.5 | 5.5 | 9.0 |
| Akron | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Canton | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Cincinnati | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Cleveland | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Columbus | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Dayton | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Lima | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Mansfield | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Marion | 12 | 9.0 | 12.0 | 5.5 | 9.0 |
| Portsmouth | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Toledo | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Youngstown | 12 | 9.5 | 12.5 | 5.5 | 9.0 |
| Zanesville | 12 | 9.5 | 12.5 | 5.5 | 9.0 |

**Aviation Gasoline—Statewide**

| | Consumer T.W. | Gasoline Taxes |
|---|---|---|
| Sohio Aviation Gasoline clear Spec. AN-F-22 | 14.5 | 5.5 |
| Esso Ethyl Aviation 73 Oct. | 15.5 | 5.5 |
| Esso Ethyl Aviation 80 Oct. | 16.5 | 5.5 |
| Esso Ethyl Aviation 91 Oct. | 17.5 | 5.5 |
| Esso Ethyl Aviation 100 Oct. | 24.5 | 5.5 |

| | Naphtha—T.W. Statewide | Lucas County |
|---|---|---|
| S. R. Solvent | 13.5 | 13.5 |
| D. C. Naphtha | 14.5 | 14.25 |
| V.M.&P. Naphtha | 14.5 | 14.25 |
| Varnolene | 14.5 | 14.25 |
| Sohio Solvent | 14.5 | 14.25 |

| Fuel Oils—T.W. | No. 1 | No. 2 | No. 3 | No. 4 |
|---|---|---|---|---|
| Ohio, Statewide | 8.0 | 8.0 | 7.5 | *7.25 |

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

‡Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers, 2c off consumer t.w.

*For Cleveland area only. Full compartment hose dumps.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

### ATLANTIC REFINING

Atlantic White Flash (Regular Grade)

| | Commercial T.W. | Dealer T.W. | Gaso-line Taxes | Kero-sine T.W. |
|---|---|---|---|---|
| Philadelphia, Pa. | 10.2 | 10.7 | 5.5 | 12.25 |
| Pittsburgh | 10.1 | 10.6 | 5.5 | 12.1 |
| Allentown | 10.7 | 11.2 | 5.5 | 12.6 |
| Erie | 10.1 | 10.6 | 5.5 | 12.1 |
| Scranton | 10.7 | 11.2 | 5.5 | 12.6 |
| Altoona | 10.7 | 11.2 | 5.5 | 12.6 |
| Emporium | 10.1 | 10.6 | 5.5 | 12.1 |
| Indiana | 10.7 | 11.2 | 5.5 | 12.6 |
| Uniontown | 10.1 | 10.6 | 5.5 | 12.1 |
| Harrisburg | 10.7 | 11.2 | 5.5 | 12.6 |
| Williamsport | 10.7 | 11.2 | 5.5 | 12.6 |
| Dover, Del. | .... | 11.2 | 5.5 | 12.6 |
| Wilmington, Del. | .... | 10.7 | 5.5 | 12.1 |
| Boston, Mass. | .... | 10.9 | 4.5 | .... |
| Springfield, Mass. | .... | 11.8 | 4.5 | .... |
| Worcester, Mass. | .... | 11.5 | 4.5 | .... |
| Fall River, Mass. | .... | 11 | 4.5 | .... |
| Hartford, Conn. | .... | 11.6 | 4.5 | .... |
| New Haven, Conn. | .... | 11 | 4.5 | .... |
| Providence, R. I. | .... | 11 | 4.5 | .... |
| Atlantic City, N. J. | .... | 10.7 | 4.5 | 10 |
| Camden, N. J. | .... | 10.7 | 4.5 | 10 |
| Trenton, N. J. | .... | 10.7 | 4.5 | 10 |
| Annapolis, Md. | .... | 11.05 | 5.5 | 10.8 |
| Baltimore, Md. | .... | 10.45 | 5.5 | 9.8 |
| Hagerstown, Md. | .... | 11.55 | 5.5 | 10.3 |
| Richmond, Va. | .... | 11.25 | 6.5 | 12.3 |
| Wilmington, N. C. | .... | 11.15 | 7.5 | 11.6 |
| Brunswick, Ga. | .... | 10.1 | 7.5 | *10.6 |
| Jacksonville, Fla. | .... | 10.1 | 8.5 | 11.6 |

| | Mineral Spirits T.W.† | V.M.&P. T.W.† |
|---|---|---|
| Philadelphia, Pa. | 11 | 12.5 |
| Lancaster, Pa. | 12 | 13.5 |
| Pittsburgh, Pa. | 12.5 | 13.5 |

| | Fuel Oils—T.W. 1 | 2 | 3 | 5 | 6 |
|---|---|---|---|---|---|
| Phila., Pa. | 10.1 | 9 | 9 | 5.76 | 5.04 |
| Allentown, Pa. | 10.6 | 9.3 | 9.3 | .... | .... |
| Wilmington, Del. | 10.1 | 9 | 9 | .... | .... |
| Springfield, Mass. | .... | 9.4 | 9.4 | .... | .... |
| Worcester, Mass. | .... | 9.3 | 9.3 | .... | .... |
| Hartford, Conn. | .... | 9.2 | 9.2 | .... | .... |

*Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w. except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

### S. O. KY.

Crown Gasoline (Regular)

| | †Net Crown | Gaso-line Taxes | Kero-sine T.W. |
|---|---|---|---|
| Covington, Ky. | 9.5 | 6.5 | 9.3 |
| Lexington, Ky. | 10.5 | 6.5 | 9.3 |
| Louisville, Ky. | 10 | 6.5 | 8.8 |
| Paducah, Ky. | 10 | 6.5 | 8.8 |
| Jackson, Miss. | 10 | 7.5 | *9 |
| Vicksburg, Miss. | 9.5 | 7.5 | *8.5 |
| Birmingham, Ala. | 10 | *8.5 | 9 |
| Mobile, Ala. | 9 | *9.5 | 8.5 |
| Montgomery, Ala. | 10 | *9.5 | *10 |
| Atlanta, Ga. | 11.1 | 7.5 | *11.6 |
| Augusta, Ga. | 11.1 | 7.5 | *11.1 |
| Macon, Ga. | 11.1 | 7.5 | *11.6 |
| Savannah, Ga. | 10.1 | 7.5 | *10.6 |
| Jacksonville, Fla. | 10.1 | 8.5 | 9.6 |
| Miami, Fla. | 10.1 | 8.5 | 9.6 |
| Pensacola, Fla. | 9 | *9.5 | 8 |
| Tampa, Fla. | 10.1 | 8.5 | 9.6 |

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city, Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, included in above prices.

†Consumer t.w. prices are same as net dealer prices.

### HUMBLE OIL

Humble Motor Fuel (Regular Grade)

| | Thriftane *Tank Wagon | Re-tail | (Third Grade) Thriftane *Tank Wagon | Re-tail | Gaso-line Taxes |
|---|---|---|---|---|---|
| Dallas, Tex. | 7.5 | 10.5 | 6.5 | 8.5 | 5.5 |
| Ft. Worth, Tex. | *6.5 | 10.5 | *6.0 | 8.5 | 5.5 |
| Houston, Tex. | 8.5 | 12.5 | 7.5 | 10.5 | 5.5 |
| San Ant., Tex. | 8.5 | 12.5 | 7.5 | 10.5 | 5.5 |

*Consumer tankwagon prices 1c per gallon above dealer tankwagon prices on Humble Gasoline, and Thriftane.

| | Kerosine *Tank Wagon | Retail |
|---|---|---|
| Dallas, Tex. | 7 | 10 |
| Ft. Worth, Tex. | 7 | 11 |
| Houston, Tex. | 8 | 11 |
| San Antonio, Tex. | 7 | 10 |

*To all classes of dealers & consumers.

## Canada

### PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

### IMPERIAL OIL

3-Star Imperial Gasoline (Regular Grade)

| | †Gasoline T.W. | *Gasoline Taxes | Kero-sine T.W. |
|---|---|---|---|
| Hamilton, Ont. | 16.5 | 11 | 18 |
| Toronto, Ont. | 16.5 | 11 | 18 |
| Brandon, Man. | 20.5 | 10 | 22.5 |
| Winnipeg, Man. | 20.0 | 10 | 22 |
| Regina, Sask. | 17.5 | 11 | 19.5 |
| Saskatoon, Sask. | 20.3 | 11 | 22.3 |
| Edmonton, Alta. | 18.4 | 10 | 20.4 |
| Calgary, Alta. | 15.5 | 10 | 17.5 |
| Vancouver, B. C. | 15 | 10 | 24 |
| Montreal, Que. | 16.5 | 11 | 17.5 |
| St. John, N. B. | 16 | 13 | 19 |
| Halifax, N. S. | 16 | 13 | 19 |

*Includes 3c Federal, and Provincia taxes.

†To divided & undivided dealers.

### SOCONY VACUUM

Socony Mobilgas (Regular Grade)

| | Com. Cons. T.W. | Undiv. Dlr. T.W. | Gaso-line Taxes |
|---|---|---|---|
| New York City | | | |
| Manhattan & Bronx | 10.1 | 10.6 | *5.5 |
| Kings & Queens | 10.1 | 10.6 | *5.5 |
| Richmond | 9.7 | 10.2 | *5.5 |
| Albany, N. Y. | 9.9 | 10.4 | 5.5 |
| Binghamton, N. Y. | 11 | 11.5 | 5.5 |
| Buffalo | 9.6 | 10.1 | 5.5 |
| Jamestown, N. Y. | 9.8 | 10.3 | 5.5 |
| Mt. Vernon, N. Y. | 10.1 | 10.6 | 5.5 |
| Plattsburg, N. Y. | 11 | 11.5 | 5.5 |
| Rochester, N. Y. | 10.8 | 11.3 | 5.5 |
| Syracuse, N. Y. | 10.5 | 11 | 5.5 |
| Bridgeport, Conn. | 10 | 10.5 | 4.5 |
| Danbury, Conn. | 10.5 | 11 | 4.5 |
| Hartford, Conn. | 10.6 | 11.1 | 4.5 |
| New Haven, Conn. | 10 | 10.5 | 4.5 |
| Bangor, Me. | 10.7 | 11.2 | 5.5 |
| Portland, Me. | 10.3 | 10.8 | 5.5 |
| Boston, Mass. | 9.9 | 10.4 | 4.5 |
| Concord, N. H. | 11.4 | 11.9 | 5.5 |
| Lancaster, N. H. | 12 | 12.5 | 5.5 |
| Manchester, N. H. | 11.3 | 11.8 | 5.5 |
| Providence, R. I. | 10 | 10.5 | 4.5 |
| Burlington, Vt. | 10.9 | 11.4 | 5.5 |
| Rutland, Vt. | 11 | 11.5 | 5.5 |

(Continued on next page)

## Atlantic Coast

(Prices are of refiners, FOB their refineries & their tanker terminals, & of tanker terminal operators FOB their terminals)—Prices in Effect September 3.

### MOTOR GASOLINE

| District | 72 Oct. (ASTM) | 70-74 oct. (ASTM) |
|---|---|---|
| N. Y. Harb. | Not made | 9.075 |
| N. Y. Harb., barges | " | 8.5 - 8.975 |
| Albany | " | 9.175 |
| Philadelphia | " | 9 075 |
| Baltimore | " | 8 825 |
| Norfolk | " | 8 575 |
| Wilmington, N. C. | " | 7.7-8 175 |
| Charleston | " | 8.175 |
| Savannah | " | 7 845 |
| Jacksonville | " | 7.845 |
| Miami | " | 7.845 |
| Tampa | " | 7 845 |
| Pensacola | " | 6.875 (1) |
| Mobile | " | 6.6 - 6.745 |
| New Orleans | " | 6.125 (1) |
| Portland | " | 9 375 |
| Boston | " | 9.275 |
| Providence | " | 9.275 |

### FUEL OILS

| District | KEROSINE and or NO. 1 FUEL | No. 2 | No. 3 | No. 5 | No. 6 |
|---|---|---|---|---|---|
| N. Y. Harb. | 7.1 | 6.7 | 6.7 | $1.85-$1.95(a) | $1.77 |
| N. Y. Harb., barges | 7 | 6.6 | 6.6 | .... | .... |
| Albany | 7.3 | 6.8 | 6.8 (2) | .... | $1.97 (1) |
| Philadelphia | 7.2 | 6.7 | 6.7 | $1.98 | $1.77 |
| Baltimore | 7.2 | 6.7 | 6.7 | $1.85 (1) | $1.77 |
| Norfolk | 7.1 | 6.7 | 6.7 (1) | $1.85 (1) | $1.77 |
| Wilmington, N. C. | 6.75 | 6 4 | .... | .... | .... |
| Charleston | 6.9 | 6.4 (2) | .... | $1.80 (1) | $1.72 (2) |
| Savannah | 6.55 | 5.75 (1) | .... | .... | $1.57(1) |
| Jacksonville | 6.55 | 5.75 | .... | .... | $1.57(2) |
| Miami | 6.55 | 5.75 (1) | .... | .... | .... |
| Tampa | 6.55 | 5.75 | .... | .... | $1.47 |
| Pensacola | 4.8 (1) | .... | .... | .... | .... |
| Mobile | 4.75 (2) | .... | .... | .... | .... |
| New Orleans | 4.125-4.25 | 3.75 (2) | .... | $1.05(1) | $0.97 |
| Portland | 7.3 | 6.8 | 6 8 (2) | .... | $1.77 |
| Boston | 7.2 | 6.7 | 6.7 (2) | $1 95 (2) | $1.77 |
| Providence | 7.2 | 6.7 | 6.7 (2) | $1.90 (1) | $1.77 |

(a) Price is for straight-run low pour, Test No. 5 ($1.95).

## Pacific Export

*In Ship's Bunkers, or deep tank lots:*

| Prices in Effect | Sept. 3 | August 27 |
|---|---|---|
| Diesel Fuel, Pac. Spec. 200 | $1.45 | $1.45 |
| Grade C fuel, Pac. Spec. 400 | $1.10 | $1.10 |

**Seaboard Export Coastwise Prices**

## Tank Wagon Prices (Continued)

| | Mineral Spirits T.W. | V.M.&P T.W. |
|---|---|---|
| Buffalo, N. Y. | 10.9 | 12.1 |
| New York City | 11 | 12 |
| Rochester, N. Y. | 11.8 | 13.1 |
| Syracuse, N. Y. | 12.2 | .... |
| Boston, Mass. | 12 | 13 |
| Bridgeport, Conn. | †16.3 | †17.3 |
| Hartford, Conn. | †16.3 | †17.3 |
| Providence, R. I. | 13 | 14 |

| | Kerosine Yard | Kerosine T.W. | Mobilfuel Diesel T.C. | Mobilfuel Diesel T.W. | Mobilheat Fuel Yard | Mobilheat Fuel T.W. |
|---|---|---|---|---|---|---|
| **New York:** | | | | | | |
| Manhat'n & Bronx | 7.5 | 10.3 | ... | 9.3 | 7.1 | 9 |
| Kings & Queens | 7.5 | 10.3 | ... | 9.3 | 7.1 | 9 |
| Richmond | 7.5 | 10.3 | ... | ... | 7.1 | 9.0 |
| Albany | 7.5 | 9.8 | 6.8 | 9.3 | 7 | 9 |
| Binghamton | 8.9 | 11.2 | ... | 10.7 | 8.4 | 10.2 |
| Buffalo | 8 1 | 10.4 | 7.5 | 9.8 | 7.7 | 9.5 |
| Jamestown | 8 2 | 10.5 | ... | 10.1 | 7.8 | 9.5 |
| Mt. Vernon | 7.6 | 10.3 | ... | 9.4 | 7.2 | 9 |
| Plattsburg | 8.1 | 10.4 | ... | 9.9 | 7.6 | 9.4 |
| Rochester | 8 7 | 11 | 7.9 | 10.2 | 7.9 | 9.7 |
| Syracuse | 8.5 | 10.8 | 7.8 | 10.1 | 7.8 | 9.6 |
| **Conn.:** | | | | | | |
| Bridgeport | 7.8 | 10.3 | ... | .... | 7.3 | 9.0 |
| Danbury | 8.2 | 10.8 | ... | .... | 7.8 | 8.5 |
| Hartford | 8 0 | 10.5 | ... | 9.5 | 7.4 | 9.2 |
| New Haven | 7.5 | 10.3 | ... | 9.3 | 7.1 | 9.0 |
| **Maine:** | | | | | | |
| Bangor | 7.9 | 10.3 | 7.4 | 9.7 | 7.4 | 9.1 |
| Portland | 7.5 | 10.2 | 6.8 | 9.3 | 7 | 9 |
| **Mass.:** | | | | | | |
| Boston | 7.8 | 10.6 | 6.7 | 9.2 | 7.1 | 9 |
| **N. H.:** | | | | | | |
| Concord | 8.4 | 10.7 | ... | ... | 8.2 | 10 |
| Lancaster | 9.5 | 11.8 | ... | .... | 9.2 | 11 |
| Manchester | 8.5 | 11.1 | ... | .... | 7.9 | 9.7 |
| **R. I.:** | | | | | | |
| Providence | 7.8 | 10.1 | 6.7 | 9.2 | 7.1 | 9.0 |
| **Vermont:** | | | | | | |
| Burlington | 8.1 | 10.4 | 7.5 | 9.8 | 7.5 | 9.2 |
| Rutland | 8.3 | 10.6 | ... | 10 | 7.7 | 9.5 |

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).
†In steel barrels
Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

## EXPORT PRICES

Effective September 3

| | Mexican Gulf Ports U. S. Dollars per Bbl. Bunker C | Diesel |
|---|---|---|
| Tampico | $0.97 | $1.65 |
| Veracruz | 0.97 | .... |
| Coatzacoalcos | 0.97 | 1.65 |
| | **Pacific Coast** | |
| Guaymas | $1.50 | $3.22 |
| Mazatlan | 1.50 | 3.22 |
| Acapulco | 1.50 | 2.89 |
| Manzanillo | 1.50 | 2.89 |
| Salina Cruz | 1.50 | 2.89 |

| | Bunker C Fuel Ships' bunkers (Ex Lighterage) | Diesel Oil Ships' bunkers (Ex Lighterage) | Diesel Oil Shore Plants | Gas House Gas Oil 28-34 Gravity |
|---|---|---|---|---|
| New Haven | $1 77 | .... | .... | .... |
| N. Y. Harbor | $1.77 | $2.78 | 6.7 (1) | 6.8 (2) |
| Albany | $1 97 (1) | $2.94 (1) | 6.8 (1) | 7 (1) |
| Philadelphia | $1 77 | $2 78 | .... | .... |
| Baltimore | $1 77 | $2.78 | 6.7 (1) | 6 7 (1) |
| Norfolk | $1.77 | $2.78 | 6.7 (1) | 6.7 (1) |
| Charleston | $1 72 (2) | $2.65 (2) | 6.4 (1) | 6.4 (1) |
| Savannah | $1.57 (1) | $2 52 (1) | .... | .... |
| Jacksonville | $1.57(2) | $2.41 (2) | .... | .... |
| Tampa | $1.47 | $2.41 (2) | .... | .... |
| New Orleans | $0.97 | $1.65 (1) | 4 (1) | .... |
| Portland | $1.77 | .... | 6 8 (1) | 6 9 (1) |
| Boston | $1.77 | $2 78 (2) | 6.7 (2) | 6.8 (2) |
| Providence | $1.77 | $2.78 (2) | 6.7 (1) | 6.8 (1) |

Bunker "C" when from Navy storage at New York and Norfolk to out-going vessels ships $1.72. (Subject to cancellation.)

## Gulf Coast

Prices in Effect September 3

| MOTOR GASOLINE | New Orleans & Lower Mississippi to Baton Rouge Tank Cars | New Orleans & Lower Mississippi to Baton Rouge Barges | Texas Gulf Coast South of New Orleans Tank Cars | Texas Gulf Coast South of New Orleans Barges | CARGOES Domestic & Export From all Gulf Ports |
|---|---|---|---|---|---|
| **Leaded (oct. by ASTM)** | | | | | |
| 76 oct. | 6.75 | 6.5 | 6.75 | 6.75 | 6 7 |
| 70-74 oct. | 6 - 6.125 | 5.625 | 5.625-6.375 (a) | 5.625 | 5.625 |
| 63-65 oct. | .... | .... | .... | .... | .... |
| **Unleaded 70 oct.** | .... | .... | .... | .... | 5.625 |
| 67-68 oct. | .... | .... | .... | .... | .... |
| 65 oct. | .... | .... | .... | .... | 5.25 |
| 60 oct. | .... | .... | .... | .... | 5 |
| **KEROSINE & LIGHT FUELS** | | | | | |
| 41-43 w w. kero. | 4.125- 4.25 | 4.125 | 4.125- 4.25 | 4 125 | 4.125 |
| 42-44 w.w. kero. | .... | .... | 4.125 | 4 125 | 4.125 |
| No 2 fuel oil | 3.75 | 3.75 | 3.75 - 4 | 3.75 | 3.75 |
| **DIESEL & GAS OILS** | | | | | |
| (In diesel index No.) | | | | | |
| No. 5 fuel oil | $1.05 | .... | $1.05 | .... | .... |
| 43-47 di | .... | .... | .... | .... | 4 |
| 48-52 di | 4 | 4 | 4 | .... | 4 |
| 53-57 di | 4.125 | .... | 4.125 | 4.125 | 4.125 |
| 58 and above | 4.25 | .... | 4.25 | .... | 4.25 |

(a) 5.625c for Dist. 1 and 6.125-6.375c for other districts.
NOTE: Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

| Heavy Fuels & Bunker Oil (at all Gulf Ports) Heavy Diesels | In Cargoes | In Ship's Bunkers (Ex Lighterage) |
|---|---|---|
| Below 28 API Grav. | .... | $1.35 |
| 28 & above API Grav. | .... | $1.65 |
| Bunker C Oil | $0.97 | $0.97 |

## Mid-Continent Lubes

(At Gulf; in packages, FAS.; in bulk, FOB terminals).

Prices in Effect September 3

| | Steel Drums | Bulk |
|---|---|---|
| Bright Stock | | |
| *D color, Vis at 210°* | | |
| 200 vis. | .... | .... |
| 150 vis., 0-10 p.p. | 32.65 (1&a) | 24.8 (1) |
| 100 vis., 0-10 p.p. | .... | .... |
| 100 vis., 10-25 p.p. | .... | .... |
| Neutral—No. 3 color | | |
| 200 vis., 0-10 p.p. | .... | .... |

(A) FAS at New Orleans.

## Wax

(Melting points are AMP, 3° higher than EMP) Prices are FOB refinery and do not include bag; freight or export differentials).

Prices in Effect September 3

| Crude Scale | New Orleans Export | N. Y. Domestic | N. Y. Export |
|---|---|---|---|
| 124-6 Yellow | 4.25 (1) | .... | 4.25 (1) |
| 122-4 White | .... | 4.25 (2) | 4.25 (2) |
| 124-6 White | 4.25 (1) | 4.25 | 4.25 |
| **Fully Refined:** | | | |
| 123-5 | 5.2 (1) | 5.2 (2) | 5.2 (1) |
| 125-7 | 5.2 (1) | 5.2 (2) | 5.2 (1) |
| 128-30 | 5.6 (1) | 5.6 | 5.6 (1) |
| 130-32 | 5.85 (1) | 5.85 (2) | 5.85 (1) |
| 133-5 | 6.15 (1) | 6.15 | 6.15 (1) |
| 135-7 | 6.4 (1) | 6.4 (1) | 6.4 (1) |

## Naphtha

Prices in Effect September 3

| | V.M.&P. Naphtha | Mineral Spirits |
|---|---|---|
| New York Harbor | 11 (2) | 10 |
| Philadelphia | 11 (2) | 10 |
| Baltimore | 10.5 (2) | 9.5 |
| Boston | 11.5 (2) | 10.5 |
| Providence | 11.5 (1) | 10.5 (2) |

## Pacific Coast Demand

*(Bureau of Mines figures in thousands of bbls. daily)*

| | Gasoline | | Gas Oil & Diesel | | Heavy Fuel Oil | | All Products | |
|---|---|---|---|---|---|---|---|---|
| | 1944 | 1945 | 1944 | 1945 | 1944 | 1945 | 1944 | 1945 |
| January | 275 | 304 | 103 | 104 | 505 | 545 | 993 | 1,066 |
| February | 315 | 315 | 109 | 100 | 478 | 594 | 1,011 | 1,124 |
| March | 311 | 332 | 108 | 94 | 479 | 519 | 1,018 | 1,068 |
| April | 302 | 406 | 58 | 83 | 450 | 536 | 954 | 1,148 |
| May | 295 | 402 | 85 | 75 | 411 | 520 | 900 | 1,135 |
| June | 352 | 398 | 87 | 64 | 395 | 490 | 969 | 1,085 |
| July | 335 | ... | 63 | ... | 353 | ... | 884 | .... |
| Aug. | 329 | ... | 63 | ... | 349 | ... | 883 | .... |
| Sept. | 323 | ... | 65 | ... | 382 | ... | 902 | .... |
| Oct. | 313 | ... | 70 | ... | 450 | ... | 945 | .... |
| Nov. | 328 | ... | 80 | ... | 467 | ... | 992 | .... |
| Dec. | 319 | ... | 101 | ... | 558 | ... | 1,093 | .... |
| Jan.-June | 308 | 360 | 97 | 87 | 453 | 533 | 974 | 1,104 |

## Mid-Continent Lube Statistics (May 1945)

*(Compiled by Western Petroleum Refiners Assn. from reports of member companies. Figures in bbls. of 42 gal.)*

| | Bright Stock | Viscous Neutrals | Paraffin Oils | Steam Refined Stock | Blended Oils |
|---|---|---|---|---|---|
| Production | 245,342 | 295,098 | 83,376 | 28,784 | 354,845 |
| Shipments: | | | | | |
| Domestic | 269,726 | 298,073 | 78,901 | 26,413 | 352,317 |
| Export | 6,633 | 595 | 10 | 480 | 6,567 |
| Total | 276,359 | 298,668 | 78,911 | 26,893 | 358,884 |
| Inventory May 30 | 162,129 | 227,211 | 65,703 | 45,248 | 121,092 |

## Pennsylvania Lubricating Oils

*(Compiled by National Petroleum Assn. from reports of companies refining Pennsylvania Grade crude oil. Figures in bbls.)*

| | Production June 1945 | Inventory June 1945 | Production May 1945 | Inventory May 1945 |
|---|---|---|---|---|
| Raw Long Residuum | 48,826 | 28,973 | 50,776 | 21,442 |
| 600 Steam Refined Stock | 244,508 | 119,879 | 245,503 | 102,442 |
| Other Steam Refined Stock | 43,136 | 34,621 | 46,556 | 31,203 |
| Finished dewaxed Long Residuum | 46,427 | 25,255 | 51,880 | 31,307 |
| Bright Stock | 154,216 | 137,669 | 167,541 | 166,081 |
| Viscous Neutral (below 180 Vis.) | 45,028 | 110,482 | 56,237 | 121,691 |
| Viscous Neutral (180 Vis. at 100) | 99,915 | 107,154 | 93,593 | 94,044 |

## Production of Natural 'Gas,' Allied Products

| | June 1945 | May 1945 |
|---|---|---|
| East Coast | ..... | ..... |
| W. New York | 1 | ..... |
| W. Pennsylvania | 986 | 1,179 |
| West Virginia | 6,142 | 7,368 |
| Ohio | 426 | 527 |
| Illinois | 14,966 | 15,335 |
| Kentucky | 4,025 | 4,500 |
| Michigan | 1,174 | 1,134 |
| Kansas | 6,061 | 6,002 |
| Oklahoma | 33,963 | 35,928 |
| Texas | 177,534 | 187,467 |
| Gulf | 43,765 | 44,811 |
| East Texas | 32,859 | 33,737 |
| Panhandle | 41,629 | 46,361 |
| Other | 59,281 | 62,558 |
| Arkansas | 7,331 | 7,378 |
| Louisiana | 48,121 | 48,538 |
| Gulf | 26,922 | 27,178 |
| Inland | 21,199 | 21,360 |
| New Mexico | 9,155 | 8,914 |
| Colorado | * | * |
| Montana | 317 | 403 |
| Wyoming | *4,559 | *5,186 |
| California | 75,032 | 77,834 |
| Total | 389,786 | 407,695 |
| Daily average | 12,993 | 13,151 |
| Total (thousands of bbls). | 9,281 | 9,707 |

* Wyoming includes Colorado drip gasoline.

## Dealer and Service Station Gasoline Prices in 50 Representative U. S. Cities April, 1945

| City | Dealers' Net Price (Ex. Tax) | Service Station (Ex. Tax) | Gasoline Tax (Inc. 1½ Cent Federal Tax) | Service Station (Inc. Tax) |
|---|---|---|---|---|
| Portland, Me. | 10.80 | 4.0 | 5.50 | 20.30 |
| Manchester, N. H. | 11.80 | 4.1 | 5.50 | 21.40 |
| Burlington, Vt. | 11.40 | 4.0 | 5.50 | 20.90 |
| Boston, Mass. | 10.40 | 4.0 | 4.50 | 18.90 |
| Providence, R. I. | 10.50 | 4.2 | 4.50 | 19.20 |
| Hartford, Conn. | 11.10 | 4.0 | 4.50 | 19.60 |
| Buffalo, N. Y. | 10.10 | 4.2 | 5.50 | 19.80 |
| New York, N. Y. | 10.60 | 5.4 | 5.50 | 21.50 |
| Newark, N. J. | 10.20 | 5.0 | 4.50 | 19.70 |
| Philadelphia, Pa. | 10.20 | 4.2 | 5.50 | 19.90 |
| Dover, Del. | 10.70 | 4.3 | 5.50 | 20.50 |
| Baltimore, Md. | 9.95 | 4.05 | 5.50 | 19.50 |
| Washington, D. C. | 10.20 | 4.0 | 4.50 | 18.70 |
| Charleston, W. Va. | 11.65 | 4.05 | 6.50 | 22.20 |
| Norfolk, Va. | 10.45 | 5.55 | 6.50 | 22.50 |
| Charlotte, N. C. | 11.70 | 4.0 | 7.50 | 23.20 |
| Charleston, S. C. | 10.55 | 4.75 | 7.50 | 22.80 |
| Atlanta, Ga. | 11.10 | 4.0 | 7.50 | 22.60 |
| Jacksonville, Fla. | 10.10 | 4.0 | 8.50 | 22.60 |
| Birmingham, Ala. | 10.00 | 5.0 | 8.50 | *23.50 |
| Vicksburg, Miss. | 9.50 | 5.0 | 7.50 | 22.00 |
| Memphis, Tenn. | 8.90 | 4.5 | 8.50 | 21.90 |
| Lexington, Ky. | 10.50 | 3.5 | 6.50 | 20.50 |
| Youngstown, Ohio | 9.50 | 3.0 | 5.50 | 18.00 |
| South Bend, Ind. | 10.50 | 4.5 | 5.50 | 20.50 |
| Chicago, Ill. | 9.60 | 2.76 | 4.50 | 16.86 |
| Detroit, Mich. | 9.90 | 3.74 | 4.50 | 18.14 |
| Milwaukee, Wisc. | 10.60 | 4.3 | 5.50 | 20.40 |
| Twin Cities, Minn. | 10.40 | 4.5 | 5.50 | 20.40 |
| Fargo, N. Dak. | 11.40 | 4.0 | 5.50 | 20.90 |
| Huron, S. Dak. | 10.80 | 3.7 | 5.50 | 20.00 |
| Omaha, Neb. | 9.60 | 3.0 | 6.50 | 19.10 |
| Des Moines, Ia. | 9.90 | 3.5 | 4.50 | 17.90 |
| St. Louis, Mo. | 9.50 | 3.0 | 4.50 | *17.00 |
| Wichita, Kans. | 8.80 | 3.2 | 4.50 | 16.50 |
| Tulsa, Okla. | 8.00 | 3.0 | 7.00 | 18.00 |
| Little Rock, Ark. | 9.50 | 4.5 | 8.00 | 22.00 |
| New Orleans, La. | 8.75 | 4.75 | 8.50 | 22.00 |
| Houston, Texas | 8.50 | 4.5 | 5.50 | 18.50 |
| Albuquerque, N. Mex. | 10.50 | 4.5 | 7.00 | †22.00 |
| Denver, Colo. | 10.00 | 4.0 | 5.50 | 19.50 |
| Casper, Wyo. | 11.50 | 5.0 | 5.50 | 22.00 |
| Butte, Mont. | 9.50 | 4.0 | 6.50 | 20.00 |
| Boise, Ida. | 13.50 | 4.0 | 7.50 | 25.00 |
| Salt Lake City, Utah | 13.50 | 4.5 | 5.50 | 23.50 |
| Reno, Nev. | 12.00 | 4.0 | 5.50 | 21.50 |
| Phoenix, Ariz. | 12.00 | 4.0 | 6.50 | 22.50 |
| San Francisco, Cal. | 10.00 | 4.0 | 4.50 | 18.50 |
| Portland, Ore. | 10.50 | 4.0 | 6.50 | 21.00 |
| Spokane, Wash. | 12.50 | 4.0 | 6.50 | 23.00 |

*Includes City Tax of $1.00; †Includes City Tax of $.50.

## Pennsylvania Oils Other Than Lubes At Refineries

*(Compiled by National Petroleum Assn. from reports of oil region refiners. Figures in barrels.)*

| | June, 1945 | May, 1945 |
|---|---|---|
| Naphthas & Gasoline | | |
| (a) Straight run unblended and/or unleaded for sale as motor fuel | 3,579 | 3,244 |
| (b) Naphtha and gasoline for sale for blending or further refining, or held at refinery for further distillation, reforming blending or leading | 246,303 | 261,955 |
| (c) below 65 octane not included in (a) or (b) above | 9,968 | 9,964 |
| (d) 65 octane and above | 197,556 | 192,112 |
| Salable naphthas other than motor fuel material (Does not include refinery process naphthas) | 12,531 | 13,480 |
| Kerosine | 73,211 | 64,815 |
| 36/40 gas oil (includes furnace oil) | 44,862 | 40,657 |
| Fuel oil (not reported above) | 43,833 | 35,811 |
| Oils held as cracking plant charging stocks | 389,312 | 400,447 |
| Non-viscous neutral | 29,677 | 32,221 |
| Wax distillate | 89,658 | 85,728 |
| Crude petrolatum | 29,095 | 36,200 |
| Wax (lbs.) | 3,228,064 | 3,314,289 |

## Net Stocks Of Pennsylvania Crude Oil

*(Compiled by National Petroleum Assn. Figures in bbls.)*

| | June 30, 1945 | May 31, 1945 | June 30, 1944 |
|---|---|---|---|
| At Refineries | 288,323 | 339,343 | 331,091 |
| Pipeline and Tank Farm | 1,462,437 | 1,455,068 | 1,730,069 |

## REFINERY OPERATIONS

*(American Petroleum Institute figures in thousands of barrels of 42 gal. each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)*

| Districts | Daily Average Crude Runs to Stills Week Ended Aug. 25 | Daily Average Crude Runs to Stills Week Ended Aug. 18 | Gasoline Production at Refineries inc. Natural Blended Week Ended Aug. 25 | Gasoline Production at Refineries inc. Natural Blended Week Ended Aug. 18 | Kerosine Production Week Ended Aug. 25 | Kerosine Production Week Ended Aug. 18 | Gas Oil & Dist. Fuel Oil Production Week Ended Aug. 25 | Gas Oil & Dist. Fuel Oil Production Week Ended Aug. 18 | Residual Fuel Oil Production Week Ended Aug. 25 | Residual Fuel Oil Production Week Ended Aug. 18 | Total Stocks Kerosine Week Ended Aug. 25 | Total Stocks Kerosine Week Ended Aug. 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East Coast | 803 | 810 | 2,291 | 1,966 | 234 | 255 | 1,052 | 1,127 | 1,863 | 1,877 | 5,158 | 4,827 |
| Appalachian (Dist. 1) | 101 | 106 | 285 | 323 | 62 | 58 | 75 | 71 | 66 | 75 | 373 | 381 |
| Appalachian (Dist. 2) | 62 | 62 | 184 | 214 | 4 | 9 | 45 | 46 | 92 | 113 | 66 | 60 |
| Ind., Ill., Ky. | 768 | 779 | 2,804 | 2,910 | 300 | 284 | 652 | 665 | 962 | 1,056 | 2,571 | 2,367 |
| Okla., Kans., Mo. | 396 | 410 | 1,489 | 1,551 | 149 | 109 | 416 | 441 | 530 | 540 | 916 | 903 |
| Inland Texas | 255 | 251 | 1,032 | 1,007 | 96 | 81 | 148 | 140 | 443 | 468 | 294 | 287 |
| Texas Gulf Coast | 1,210 | 1,248 | 3,840 | 3,697 | 453 | 461 | 1,493 | 1,414 | 1,667 | 1,839 | 1,568 | 1,702 |
| Louisiana Gulf Coast | 250 | 282 | 793 | 956 | 202 | 256 | 277 | 402 | 342 | 414 | 877 | 789 |
| No. La. & Arkansas | 64 | 76 | 170 | 237 | 27 | 43 | 52 | 66 | 103 | 131 | 319 | 174 |
| Rocky Mt. (Dist 3) | 13 | 14 | 39 | 41 | 6 | 6 | 12 | 12 | 31 | 29 | 15 | 15 |
| Rocky Mt. (Dist. 4) | 108 | 123 | 372 | 407 | 6 | 8 | 101 | 93 | 232 | 282 | 101 | 101 |
| California | 901 | 979 | 2,687 | 2,581 | 34 | 57 | 637 | 867 | 3,025 | 3,110 | 438 | 449 |
| Total U. S.—B. of M. Basis | 4,931 | 5,140 | 15,986 | 15,890 | 1,573 | 1,627 | 4,960 | 5,344 | 9,356 | 9,934 | 12,696 | 12,046 |
| U. S.—B. of M. Basis, Aug. 26, 1944 | 4,690 | 4,685 | 14,242 | 13,913 | 1,424 | 1,491 | 4,486 | 4,657 | 8,558 | 8,876 | 13,101 | 13,052 |

| Districts | Total Stocks Gas oil and Distillates Week Ended Aug. 25 | Total Stocks Gas oil and Distillates Week Ended Aug. 18 | Total Stocks Residual Fuel Oil Week Ended Aug. 25 | Total Stocks Residual Fuel Oil Week Ended Aug. 18 | Gasoline Stocks—*Military and Other** Week Ended Aug. 25 | Gasoline Stocks—*Military and Other** Week Ended Aug. 18 | Gasoline Stocks—Civilian Grade Week Ended Aug. 25 | Gasoline Stocks—Civilian Grade Week Ended Aug. 18 |
|---|---|---|---|---|---|---|---|---|
| East Coast | 11,091 | 10,534 | 7,733 | 7,003 | 5,257 | 6,443 | 9,041 | 8,104 |
| Appalachian (Dist. 1) | 494 | 866 | 270 | 281 | 1,726 | 1,358 | 1,262 | 1,357 |
| Appalachian (Dist. 2) | 535 | 172 | 184 | 180 | 244 | 223 | 653 | 1,079 |
| Ind., Ill., Ky. | 5,746 | 5,135 | 2,876 | 2,908 | 5,559 | 5,994 | 12,477 | 12,940 |
| Okla., Kans., Mo. | 2,381 | 2,384 | 1,393 | 1,428 | 1,497 | 1,544 | 6,234 | 6,450 |
| Inland Texas | 562 | 439 | 973 | 1,018 | 1,040 | 1,008 | 1,495 | 1,723 |
| Texas Gulf Coast | 5,433 | 4,896 | 5,867 | 5,994 | 10,142 | 9,704 | 6,030 | 6,099 |
| Louisiana Gulf Coast | 1,663 | 1,865 | 1,023 | 1,020 | 1,934 | 1,879 | 1,998 | 2,342 |
| N. La. & Arkansas | 790 | 1,431 | 224 | 247 | 177 | 164 | 2,202 | 1,721 |
| Rocky Mt. (Dist. 3) | 21 | 21 | 38 | 38 | 15 | 11 | 77 | 80 |
| Rocky Mt. (Dist. 4) | 392 | 372 | 646 | 632 | 609 | 683 | 1,290 | 1,394 |
| California | 10,676 | 10,560 | 24,974 | 24,096 | 9,648 | 10,283 | 4,086 | 3,402 |
| Total U.S.—B. of M. Basis | 39,782 | 38,675 | 46,201 | 44,845 | 37,848 | 39,294 | 46,845 | 46,691 |
| U. S.—B. of M. Basis Aug. 26, 1944 | 40,538 | 39,520 | 59,396 | 58,862 | 37,438 | 37,983 | 41,731 | 41,925 |

*Includes aviation and military grades, finished and unfinished, title to which remains in the name of the producing company; solvents, naphthas, blending stocks currently indeterminate as to ultimate use, 10,657,000 bbl. unfinished gasoline this week, compared with 11,705,000 bbl. a year ago.

**These figures do not include any gasoline on which title has already passed, or which the military forces may have in their own or leased storage.

Percent Daily Refining Capacity Reporting—East Coast, 99.5; Appalachian (Dist. 1) 76.8, (Dist. 2) 81.2; Ind., Ill., Ky., 87.2; Okla., Kans., Mo., 78.3; Inland Texas, 59.8; Texas Gulf Coast, 89.3; Louisiana Gulf Coast, 96.8; No. Louisiana & Arkansas, 59.9; Rocky Mt. (Dist. 3) 17.1; (Dist. 4) 72.1; California, 87.3; Total—U. S.—B. of M. Basis Aug. 25, 1945 85.8; Total—B. of M. Basis Aug. 18, 1945 85.8.

## U. S. Crude Oil Production

*(American Petroleum Institute figures)*

| | WEEK ENDED Barrels (Daily Average) Aug. 25 | Barrels (Daily Average) Aug. 18 |
|---|---|---|
| Oklahoma | *389,000 | 391,000 |
| Kansas | *266,550 | 275,700 |
| Nebraska | *850 | 850 |
| Texas | 2,223,300 | 2,223,300 |
| Louisiana | 365,450 | 365,050 |
| Arkansas | 79,000 | 79,950 |
| Mississippi | 53,650 | 55,100 |
| Alabama | 1,000 | 950 |
| Florida | 200 | 200 |
| Illinois | 198,250 | 205,100 |
| Indiana | 13,100 | 13,450 |
| Eastern (Ill., Ind. & Ky. excluded) | 65,750 | 61,100 |
| Kentucky | 28,400 | 28,850 |
| Michigan | 46,700 | 47,000 |
| Wyoming | 115,050 | 115,950 |
| Montana | 20,350 | 20,400 |
| Colorado | 11,750 | 10,700 |
| New Mexico | 102,900 | 102,900 |
| California | 910,300 | 936,300 |
| Total, U. S. | 4,891,550 | 4,933,850 |

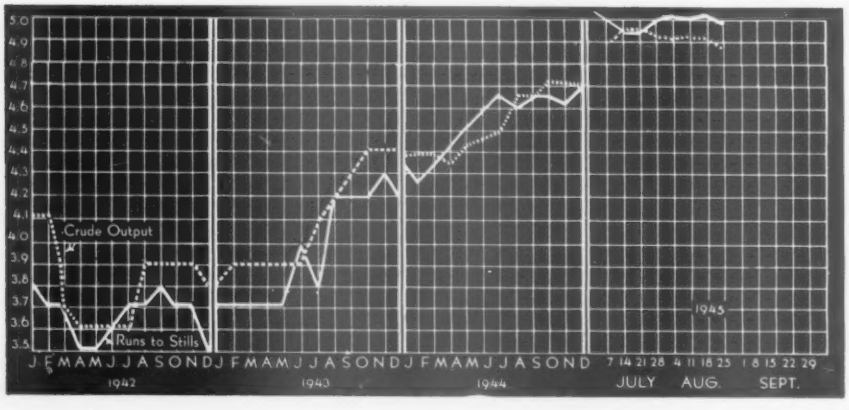
*Okla., Kans., Neb. figures are for week ended 7:00 a.m. Aug. 22, 1945.

## Crude Oil Stocks

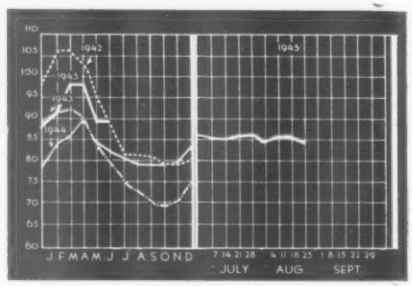
*(Bureau of Mines Figures in thousands of bbls.)*

| Grade or Origin | Aug. 18 | Aug. 25 | Change from Aug. 18 |
|---|---|---|---|
| Pennsylvania Grade | 2,071 | 2,038 | — 33 |
| Other Appalachian | 1,295 | 1,339 | + 44 |
| Lima-Michigan | 909 | 896 | — 13 |
| Illinois-Indiana | 12,424 | 12,061 | — 363 |
| Arkansas | 2,628 | 2,676 | + 48 |
| Kansas | 8,695 | 8,878 | + 183 |
| Louisiana: | 12,685 | 12,538 | — 147 |
| Northern | 3,145 | 3,170 | + 25 |
| Gulf Coast | 9,540 | 9,368 | — 172 |
| Mississippi | 1,424 | 1,488 | + 64 |
| New Mexico | 5,925 | 5,963 | + 38 |
| Oklahoma | 32,240 | 31,727 | — 513 |
| Texas: | 104,531 | 105,257 | + 726 |
| East Texas | 18,105 | 18,243 | + 138 |
| West Texas | 30,778 | 31,340 | + 562 |
| Gulf Texas | 28,429 | 28,231 | — 198 |
| Other Texas | 27,219 | 27,443 | + 224 |
| Panhandle | 4,439 | 4,258 | — 181 |
| North | 6,760 | 7,076 | + 316 |
| South | 7,526 | 7,783 | + 257 |
| Other | 8,494 | 8,326 | — 168 |
| Rocky Mountain | 6,639 | 6,796 | + 157 |
| California | 17,002 | 16,801 | — 201 |
| Foreign | 3,442 | 3,355 | — 87 |
| Total gasoline-bearing in U.S. | 211,910 | 211,813 | — 97 |
| Heavy in Calif. | 4,873 | 4,585 | — 288 |

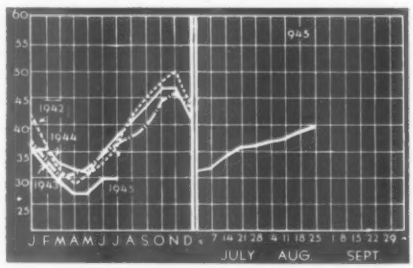
Crude Production & Runs to Stills *(Millions of Barrels)*



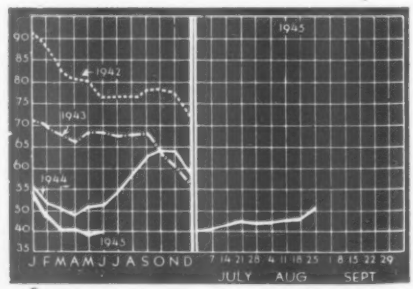

Gasoline Stocks *(Millions of Barrels)*



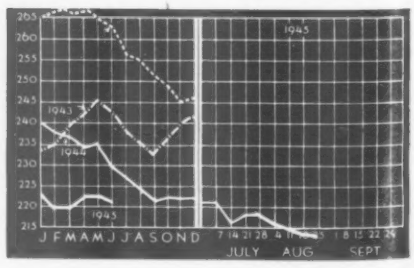

Gas Oil & Distillate Stocks *(Millions of Bbls.)*




Residual Fuel Oil Stocks *(Millions of Bbls.)*




Crude Oil Stocks *(Millions of Barrels)*



## *Dist. 2 PAW, Organized More Than Four Years Ago, Will Close Doors Sept. 29*

**Dist. 2, PAW will close doors September 29. Since July, 1941, it has served the oil industry. Reading from left to right, the remaining employes are: First Row: J. W. Kienzle, E. B. Daggitt, A. W. Horne, M. E. Reed, Jessie Moon, P. Greenberg, M. K. Ryan, A. J. DuMarce, J. M. Ford. Second Row: G. Tripp, R. E. Schumacher, B. A. Phelps, A. Venter, M. Dannov, E. Weinstein, H. Derby, T. E. Bauer, G. L. Chappelle, Irwin Lamp (Ass't Director-in-Charge). Third Row: E. J. Frueh, C. M. Shimkus, A. M. Walsh, E. M. Paetzke, J. D. Siemund, K. C. Gilbert, D. W. Williams, J. E. Anderlik, L. B. Holland, C. C. Brown, H. W. Nankervis, Capt. R. W. Tesch, R. E. Fitzgerald. Fourth Row: H. S. Thomas, C. H. Alberding, H. C. Walland, F. C. Wonderly, E. J. Bullock (director-in-charge), M. Kirkpatrick, S. Allen, A. Murray, C. P. Holmes, R. L. Harper, Major J. E. Scally, A. W. Gaede**

**Wirt Franklin of Oklahoma was first director-in-charge. He was succeeded by W. W. Vandeveer of Cleveland in July 1943. E. J. Bullock, present director, replaced Mr. Vandeveer in December of 1944. Dist. 2 includes states of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Kentucky, Tennessee, Ohio and Michigan**

### *Equipment Personals*

Monsanto Chemical Co. of St. Louis this week announced a number of personnel changes. **John E. Gurvin,** plant engineer of its elemental phosphorus operations at Monsanto, Tenn., was appointed vice president of Merritt Engineering and Sales Co., Lockport, N. Y., a Monsanto subsidiary. He became superintendent of construction of the Tennessee plant in 1936 and plant engineer in 1938. The promotion becomes effective Sept. 1.

**Arnold H. Smith** was appointed director of the foreign department of the company, succeeding **Herbert M. Hodges, Charles Belknap,** president of the company announced. Mr. Smith a native of Akron will be succeeded as assistant director of the foreign department by **Marshall E. Young,** formerly general export manager.

Appointment of **H. J. Heffernan** as asistant general manager of sales of Monsanto Chemical Co.'s Merrimac division in Boston, effective Sept. 1, was announced by **D. S. Dinsmoor,** divisional general manager. He succeeds the late **Horace Burrough III,** who died Aug. 9, and is in turn succeeded by **W. E. Brown,** now his assistant in the New York office.

Also announced was the promotion of **J. J. McCarthy** from the development department to the division sales department as manager of textile sales development.

Three assistant sales managers were advanced to the position of sales managers of their respective departments. They are:

**W. R. Minchin,** who becomes sales manager of the heavy chemical department of the division; **T. C. Jesdale,** who is named sales manager for organic and phosphate division products at Merrimac division; **P. O. Huntington,** now acting as assistant sales manager, who will become sales manager of the Merrimac division's alcohol department.

° ° °

The Allis-Chalmers Manufacturing Co. has announced the resignation of **Lee H. Hill,** who for the past four years has been vice president in charge of industrial relations. He will join the McGraw Hill Publishing Co. in New York.

Since the start of the war, Mr. Hill has worked on the War Labor Board and was President Truman's first appointee as a full industry member of the Board. His successor has not been named.

° ° °

The Continental Can Company has announced the appointment of **Leo Bergen,** formerly with Continental's aircraft operations plant at Jersey City, as supervisor of lithography and coating in the Eastern Division of the company.

**V. A. Leslie,** former state supervisor of Continental Cannery Equipment Service, has been named sales representative for the Michigan territory. Mr. Leslie succeeds **L. J. Wing,** who has left his Continental post after more than 30 years service.

**R. G. Stevens,** chief of the customer research district has moved his headquarters from New Orleans to the Company's Houston plant.

° ° °

**A. W. Phillips,** general superintendent of the B. F. Goodrich Co. tire division, has announced that **Walter J. Head,** formerly manager of the company's Los Angeles factory, has been named manager of the new tire plant at Miami, Okla. Mr. Head assumed his new position on August 1.

More than twenty years ago Mr. Head joined Goodrich at its Akron plant of the tire division. He has been in the Los Angeles plant since 1939.

### Dist. 2 Industry Committees Hold Final Meeting Sept. 12

NPN News Bureau

CHICAGO—Farewell meeting of the Dist. 2 industry committees will be held at the Stevens Hotel here on September 12. Winding up of finances, historical records and other details incident to preparation for permanent closing of the office will be the order of the day. The office is due to be finally and officially closed few days later.

In addition to the general committee, members of the five function committees will attend—refining, production, natural gas, supply and transportation and distribution and marketing.

# CLASSIFIED

## For Sale

FOR SALE: Six tractor-trailer Transport units in first-class condition. Immediate delivery. The General Refining Company, 2365 Wilkens Ave., Baltimore 23, Md.

FOR SALE: 4000 Gallon Springfield built 1944 tank trailer. Compartments 520-815-1325-1340, three inch lines; and 1941 Dodge 2 to 3 ton tractor with new heavy duty motor, good tires. Seltzer's Petroleum Products, 2965 Easton Ave., St. Louis 6, Mo.

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11—15,000 gal. vertical storage tanks
1—20,000 gal. horizontal storage tank

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Tel. HOgarth 0872

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New Albany, Indiana.

FOR SALE

One 1944 White WA 22 tractor and 4300 gallon Butler Twin Tank, Air brakes, 1000x20 tires perfect condition. One 1945 White WA 22 tractor and 4300 Butler Twin tank Air brakes 1000 x22 tires. Less than 30000 mile on unit.

B & T Transit Company
Smithfield, N. C.
Telephone 355

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Box No. 678

## Wanted to Buy

WANTED TO BUY: One new or used Power Pack Pump. State condition and best price. P. O. Box 151, Enterprise, Ala.

WANTED TO BUY: Truck Tank 850 to 1250 gallons, not less than (four) 4 compartments. State overall length, width, condition. If equipped with side cabinets & meter, also price wanted. Submit picture with reply to P. O. Box 887, Roanoke 5, Virginia.

WANTED:

To buy fuel oil company centrally located in Chicago, including bulk plant, trucks and business. Will pay cash.

Box No. 800
National Petroleum News
59 E. Van Buren St.
Chicago 5, Ill.

WANTED TO BUY

GASOLINE AND FUEL OIL DISTRIBUTORSHIP BUSINESS. Prefer to locate in market of 25,000 to 50,000 population which has a combination of industrial and agricultural potential. I would like to locate in the state of Ohio but will consider other locations of close proximity.

I am 44 years old, have been employed by a major rubber company for 22 years in various capacities, such as service engineer, wholesale salesman, district credit and operating manager, and at present I am supervisor of 11 successful retail stores. My capital is limited to $10,000 cash.

Replies should include information such as location, population, market potential, brand of product, equipment, years established, gallonage, percentage of net profit to sales, competition, price, and an acceptable plan for financing in excess of available capital.

Box No. 685

## Positions Wanted

SALES MANAGER experienced tank car marketing; independent refiner preferred; salary or commission. Available at once. Box No. 683.

ATTORNEY, 40, 16 years business and legal experience, 3 years with PAW, desires position where experience and abilities can be utilized. Box No. 679.

WELL ESTABLISHED petroleum products sales representative seeks new Pennsylvania refiner connection on unbranded material for Pacific Northwest; commission basis only. Excellent references. Box No. 677.

PROFESSIONAL ENGINEER desires association with progressive petroleum marketing organization. Ten years with major oil company, including executive position during extensive station and plant expansion, after eight years in design and construction. College graduate. Box No. 682.

## Situations Open

SALESMAN: Established marketing company requires aggressive married man to sell petroleum products, tank car and transport, in southern Michigan. Write stating qualifications and salary desired. Box No. 680.

CHEMICAL ENGINEER: Large midwestern oil company requires graduate Chemical Engineers for process design, process control and refinery technical service work. Positions permanent. Write Box No. 622, giving qualifications and experience if available under W.M.C. regulations.

GREASE SALESMAN FOR JOBBING TRADE

Responsible manufacturer of standard greases has opening for experienced grease salesman to call on the jobbing trade. Excellent opportunity for right man. Compensation, salary and commission. State fully experience.

Box No. 601

WANTED

CHIEF CHEMIST

Combination skimming, cracking, asphalt plant, 2500 barrel daily capacity. Must have asphalt experience and be able to supervise and direct production and blending of asphalts, road oil and diluents used in same. Supervise treating plant, including boiler feed water. Permanent position, salary $350.00 to $400.00 depending upon qualifications and experience. C. L. Crenshaw, General Manager, The Shallow Water Refining Company, Garden City, Kansas.

## Oil Equipment Salesmen

Butler needs sales engineers in various territories from the Rocky Mountains to the Atlantic Coast.

*Butler Truck Tanks*
*Butler Transport Tanks*
*Butler Storage Tanks*
*Butler Steel Industrial Buildings*
*Butler Steel Service Stations*

Tremendous backlog of equipment needed by the industry. Butler Oil Equipment a leader in the field. Backed up by national advertising. Attractive compensation for men who produce.

Inquiries solicited from experienced Oil Equipment men Give age, present connections, past contacts and territory preferred.

Salesmen now in the Armed Forces who have seen Butler Products in use around the world are also invited to write giving full information.

G. A. Burns, Mgr. Oil Equipment Division
BUTLER MFG. COMPANY,
7454 E. 13th St., Kansas City, Mo.

# ABOUT OIL PEOPLE

Last week end, **Col. Harry W. McCobb** placed his uniform in moth balls and donned mufti preparatory to rejoining the Standard Vacuum Oil Co. which he left in 1942 in Australia to go on active status with the U. S. Army.

Col. McCobb served in Australia, and later in North Africa, and became assistant executive officer of A-NPB, which was the subject of an article by NPN's editor, Warren C. Platt, on Aug. 15. He was field superintendent for Standard-Vacuum in the Netherlands East Indies from 1934 to 1942. He was with A-NPB since 1943.

* * *

**Walter J. Diehl,** who recently returned from a Jap prison camp, has been appointed Washington state district credit manager for the Tide Water Associated Oil Co. Diehl, who has been with the firm since 1927, was taken prisoner while on a tour of duty in the company's Philippine offices and spent 39 months in the Santo Tomas prison camp. He will now make his headquarters in Seattle.

* * *

**Captain Ralph L. Tompkins,** who was recently transferred to inactive duty with the U. S. Marine Corps, has been appointed manager of the White Plains, New York, branch of Mack Truck, Inc.

Capt. Tompkins joined the Mack general sales force in 1940, and later managed the firm's branch at Mineola, L. I. In 1943 he joined the Marines and served in Quantico and at the Marine Corps Air Station in Edenton, N. C.

* * *

**Warren W. Burns,** who for several years was on the editorial staff of NPN in the Los Angeles, Cleveland and Washington bureaus before enlisting in the Navy, reports that he is being transferred to Washington. He has been stationed in the Naval public relations office in San Pedro, Calif.

* * *

**Robert W. Young** has resumed his position as field service representative of the Pennsylvania Grade Crude Oil Assn. and will have his headquarters in Cleveland, Ohio, according to W. C. Wenzel, the association's executive manager.

Mr. Young was eastern representative for the association from October, 1939, to March, 1943, when he resigned to accept an assignment in war work at Bedford, Ohio. He had covered the New England-Eastern Canada territory for two years from headquarters in Boston, Mass. In 1941 he was transferred to Cleveland to represent the association in Ohio, Michigan, Indiana, Kentucky and West Virginia.

At a recent meeting of the Board of Directors of the Belcher Oil Co., Miami, Fla., **E. N. Belcher,** president of the company, was elected chairman of the board. **C. B. Chinn,** secretary and treasurer, was named to succeed Mr. Belcher as president.

The company's new vice president and road department manager will be **J. E. Dodson,** who has been with the company for more than 20 years. **Paul E. White,** manager of the Industries Division was named a vice president and **J. A. Belcher** was named secretary and treasurer to succeed Mr. Chinn, and will begin his duties in that capacity as soon as he has been released from the armed services.

Other officers of the company are **E. N. Belcher, Jr.,** vice president and manager of the Belcher Towing Co., and **W. B. Powers,** vice president and manager of the fuel oil department.

* * *

A former oil man, **Henry A. Bourne,** has been appointed sales manager for Republic Steel Corp. in the Tulsa district. Mr. Bourne joined Republic in 1943 as a salesman. Prior to that he was district sales manager in Houston for the A. O. Smith Corp.

Following his discharge from the Navy as a petty officer at the end of World War I, Mr. Bourne spent five years in Venezuela in the oil business.

* * *

**J. R. Fitz-Hugh,** Tulsa, heads the newly formed economics department of the Carter Oil Co., Carter announced this week.

Mr. Fitz-Hugh for the past year has been co-ordinator of refining and manufacturing operations for the company. The change became effective Sept. 1.

* * *

When **Ray N. Friel** resigned his position as manager of the Detroit district for Socony-Vacuum, he was succeeded by **Arthur E. DeNio,** who has been in the sales department of the company for the past twenty-six years and was formerly assistant to Mr. Friel.

**Frank Allerton,** who has been with Socony-Vacuum for the past twenty years will be with Mr. DeNio as assistant sales manager for the district.

## C. L. Fleming Retires as Ohio Oil Vice President

**C. L. Fleming**

*Special to NPN*

FINDLAY, Ohio — Included in changes in the management ranks of The Ohio Oil Co. announced Sept. 1 by President **O. D. Donnell,** is the retirement as a director, vice president and manager of the refining department of **C. L. Fleming.**

Mr. Fleming, who retired under the company's retirement plan, completed 47 years of continuous service with the company on Sept. 1. His retirement terminates a career that began as an office boy in the company's Oil City, Pa., office on June 10, 1898. Transferred to Findlay two years later as a stenographer in the executive offices, he served in various secretarial capacities until Jan. 1, 1915, when he was made assistant secretary of the company. He was elected secretary in 1918, and in 1927 was elected to the board of directors. The following year he became vice president of the company.

In 1934 he was placed in direct charge of the company's refining and marketing operations. Under his leadership the company's refining and marketing department has steadily grown until it has become one of the major marketing organizations in the states to which its retail operations are confined.

He is a member of the API and the National Petroleum Assn., and has been a director of N.P.A. since 1942. He is prominent in local business, social, community and fraternal organizations. He is a director of the First National Bank of Findlay. He will continue to make his home in Findlay.

Following Mr. Fleming's retirement, **Wilson B. Emery,** now vice president and manager of production, was elected a member of the board of directors. **C. Z. Hardwick,** who has been assistant manager of the refining and marketing department, was elected a vice president.

# CLASSIFIED

## Situations Open

SALES EXECUTIVE: Experienced in automotive and industrial lubricants to direct activities of established national sales organization. Old, well known manufacturing company. References will not be contacted until after personal interview. Reply giving full details of experience to Box No. 681.

**WANTED**

Men familiar with fuel and lubricant application in automotive fleets. Maintenance experience desirable. Give complete description of experience. Address—
Box No. 671

National Petroleum News
Cleveland, Ohio.

## Business Opportunities

**GREASES FOR JOBBING TRADE**

Manufacturer of grease located in the East has capacity for taking on extra grease business. Will manufacture standard greases or greases to specifications at attractive prices.

Box No. 600

DISTRIBUTORS OR WHOLESALERS from Maine to California to handle sale of a new formula Dry Cleaner's Naphtha, packed in gallon containers for resale by gas stations, farm trade, or, wholesale houses supplying hardware, drug or grocery trade. Will consider exclusive franchise on quota arrangement.

Box No. 668

**ATTENTION MAJOR REFINERS**

Independent Distributor with number of company owned stations as well as dealer and consumer volume in Alabama, desires connection with National-brand refiner (or regional supplier with products accepted at major-oil level in Mid-Continent, Atlantic Seaboard or Gulf) for purpose of achieving state-wide distribution. Must be company not operating in state now or willing to relinquish state to one distributor. Advertiser capable of financing water terminal and retail expansion but will consider financial tie-up with supplier if desired. Management experienced and aggressive. Also interested Tennessee on same basis. To arrange conference address—

Box No. 672

## Professional Services

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Architects and Engineers

Specialists in Pipe Line Terminals, Bulk Storage Plants, Service Stations and related structures.

53 W. Jackson Blvd. Chicago 4, Ill.
Phone: Wabash 2992

**ANTI-KNOCK VALUES DETERMINATORS**
**The Gray Industrial Laboratories**
***Chemists and Engineers***
***Specialists on Petroleum Products***
**961-976 Frelinghuysen Ave., NEWARK, N. J.**
**Telephone Bigelow 3-4020**

The executive staff of the New Orleans division of Gulf Refining Co. will be well represented with returning World War II officers, with the return of Col. Benson and Maj. Prescott.

Lt. Col. R. F. A. Benson has returned as assistant division manager in charge of industrial and technical oil sales, and Maj. C. B. Prescott is back on the job as assistant division manager in charge of operation and distribution.

Col. Benson entered the armed services Nov. 16, 1942, with the rank of Major, and became a lieutenant colonel in March, 1944. He served as chief of production division, transportation corps, marine and rail, in Washington.

Maj. Prescott entered the Army as a captain in January, 1943, and also served in Washington in the operations branch.

° ° °

**B. B. Howard** has been elected to the board of directors of Standard Oil Co. (N. J.), it was announced here last week by Ralph W. Gallagher, chairman of the board. Mr. Howard becomes the eleventh director, following the recent retirement of Wallace E. Pratt.

Widely known in maritime circles, Mr. Howard has been associated with Jersey's large tanker fleet since he joined the company in 1920. Throughout the war he has been general manager of the company's marine group.

At the request of the British Board of Trade, he went to England in 1941 as Admiral Land's representative to expedite tanker turn-arounds in British ports and to speed up deliveries of oil from the United States. In the following year he went to India and the Suez area as a representative of the War Shipping Administration. He is president of War Emergency Tankers, Inc.; a member of the board of managers of the American Bureau of Shipping and a director of the National Federation of American Shipping and the American Merchant Marine Institute.

° ° °

**Lewis Finch Jr.** has returned to the Fort Worth (Texas) office of Stanolind Oil & Gas Co. as assistant division engineer. He formerly was at Odessa, having been transferred there from Fort Worth.

**Miss Ona Ruth Potter,** chief clerk in the geological department of the Fort Worth district of Gulf Oil Corp., has resigned to accept a position with the land department of the California Co. at New Orleans, effective Sept. 17.

° ° °

**J. L. Hoyt, Jr.,** formerly district production foreman in the Willamar Field of the Pan American Production Co., has been appointed the new superintendent of the Company Valley Division.

Mr. Hoyt has served in several fields for Pan American since 1938 and replaces **D. H. Emerson** who has retired to operate a ranch in San Marcos, Texas.


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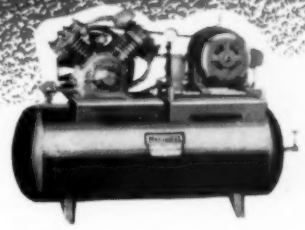


Model G-145

**AGAIN,** new National Pumps will be available in increased numbers as rapidly as necessary materials can be secured.

We suggest placing your orders now for early 1946 deliveries.

Model G-26A

Model P-5G

Model L-30S

# NATIONAL PUMPS

**SALESMEN NOTE:** Additional equipment agents will be needed to sell our complete line. Correspondence is invited.

**NATIONAL PUMPS CORPORATION** General Offices: **CINCINNATI 23, OHIO,** Factory: **DAYTON 1, OHIO**

Pacific Coast Division: **79 NEW MONTGOMERY ST., SAN FRANCISCO, CALIF.**

. . . . . NUMBER TWO OF A SERIES . . . . . .

## HOW WAR HAS PUT NEW WALLOP IN "Be *sure* with Pure"

# 10 YEARS' PROGRESS IN 2!

Pure Oil research achievements go 'way back.

Yet for Pure Oil, as for the nation's entire petroleum industry, all past research seems to have been mere "ground-work" for the amazing achievements of these war years.

Pure Oil doubled its research pay roll in the first war year and, in the first *two* war years, scored gains which would normally take *ten*.

Among the end-products of recent Pure Oil research currently important to American motorists and oil jobbers, is a complete new line of "plus tested" lubricants, measuring up to the severest wartime and peacetime demands—

The new *Tiolene Chassis Grease* that "stays put" longer under severe shocks . . . *Tiolene Heavy Duty Motor Oil,* the new Tarzan of the famous Tiolene family . . . *Purelube,* the all-purpose, E.P. lubricant that leads the field, are typical Pure-Sure products.

No need to wait until tomorrow to "Be *sure* with Pure" right down the line, for everything you sell to motorists or fleet owners, flyers or farmers.

**Be *sure* with Pure**

THE PURE OIL COMPANY, U. S. A.

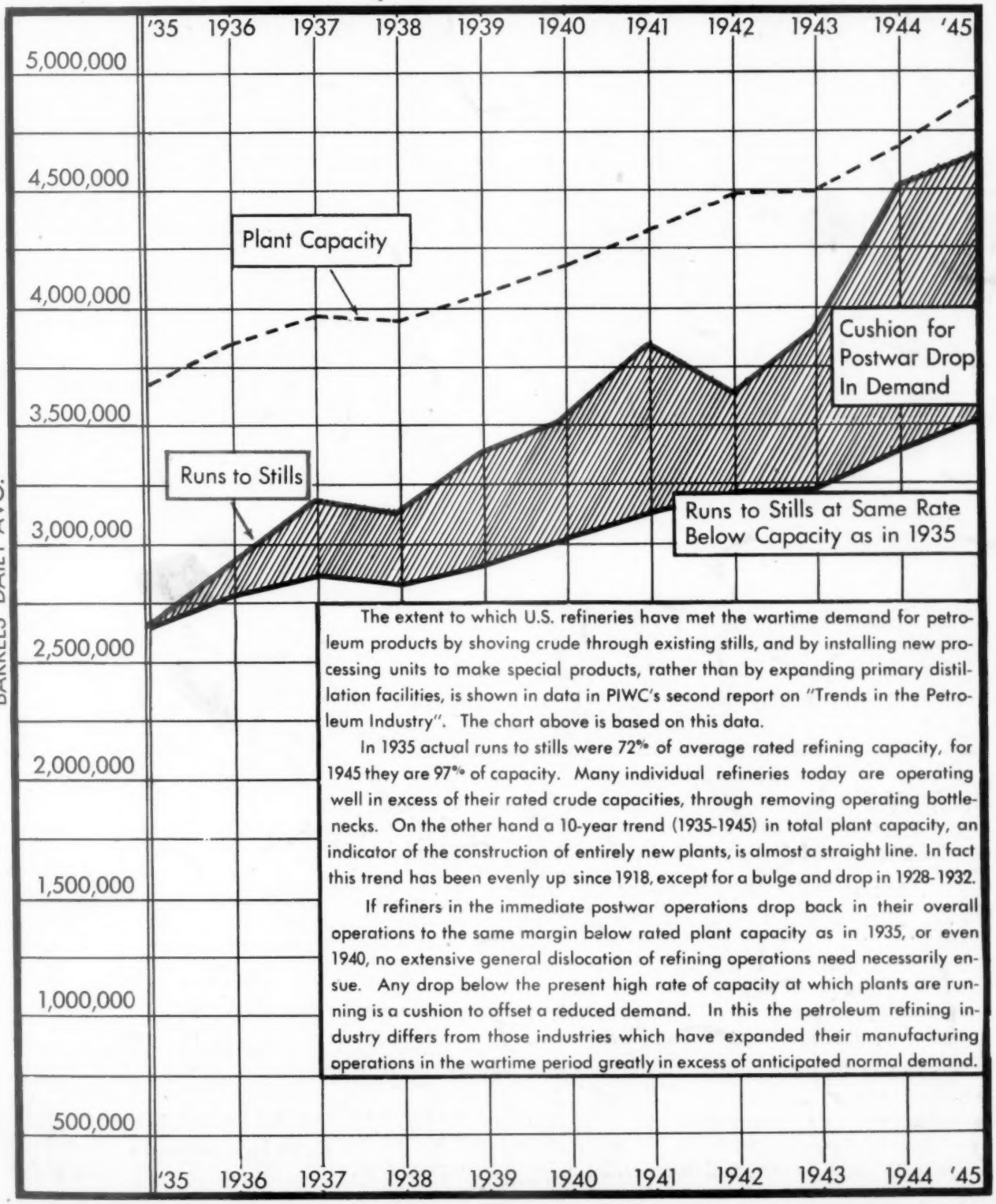
NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to
REFINERY MANAGEMENT and PETROLEUM CHEMICAL TECHNOLOGY

TECHNOLOGY DEPT.
SEP 11 1945

Section Two — September 5, 1945—Vol. 37, No. 36

# Refiners Crowd Plant Capacities Rather Than Overbuild in War




The extent to which U.S. refineries have met the wartime demand for petroleum products by shoving crude through existing stills, and by installing new processing units to make special products, rather than by expanding primary distillation facilities, is shown in data in PIWC's second report on "Trends in the Petroleum Industry". The chart above is based on this data.

In 1935 actual runs to stills were 72% of average rated refining capacity, for 1945 they are 97% of capacity. Many individual refineries today are operating well in excess of their rated crude capacities, through removing operating bottlenecks. On the other hand a 10-year trend (1935-1945) in total plant capacity, an indicator of the construction of entirely new plants, is almost a straight line. In fact this trend has been evenly up since 1918, except for a bulge and drop in 1928-1932.

If refiners in the immediate postwar operations drop back in their overall operations to the same margin below rated plant capacity as in 1935, or even 1940, no extensive general dislocation of refining operations need necessarily ensue. Any drop below the present high rate of capacity at which plants are running is a cushion to offset a reduced demand. In this the petroleum refining industry differs from those industries which have expanded their manufacturing operations in the wartime period greatly in excess of anticipated normal demand.

# Bridle Wild Horsepower

## and curb lowering reservoir pressures

MAINTENANCE of Pressure on Oil Reservoirs Thru Gas Injection Will Usually:

1. **Increase Total Oil Recovery**
2. **Minimize Lifting Costs**

A properly designed and constructed pressure maintenance plant will, in many cases, provide a return on the investment greater than that received on any other invested capital in the field development.

Thru having designed and installed plants* now daily returning many hundreds of millions of feet of gas to producing reservoirs, Hudson is equipped, thru years of successful experience, to design and install complete facilities for pressure maintenance, including gathering systems, compressor plants, hydrocarbon extraction and fractionation units, dehydration plants, and dry gas injection piping systems.

* GAS COMPRESSOR STATIONS • CYCLING PLANTS • GAS DEHYDRATION PLANTS • NATURAL GASOLINE PLANTS • FRACTIONATION UNITS • HYDROGEN SULFIDE REMOVAL PLANTS • MECHANICAL AND NATURAL DRAFT COOLING TOWERS

**HUDSON**
**ENGINEERING CORPORATION**
*Engineers and Constructers*
FAIRVIEW STATION HOUSTON, TEXAS

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# PREVIEW

## Feature Articles Coming Next Month

### Sulfonic Acid Derivatives As Lubricating Oil Additives

Only a few years ago sludge acids resulting from the sulfuric acid treating of petroleum distillates were considered waste products and caused a considerable disposal problem. Today this sludge is the source of valuable commercial byproducts — the sulfonates. Aside from many other important uses, the sulfonates are valuable lubricant improving agents; they impart extreme pressure, prevent corrosion and formation of carbon, sludge and varnish, and act as detergents, emulsifying and stabilizing agents.

These uses of sulfonic acids and their derivatives, as revealed by the numerous patents on the subject, are discussed by a chemical engineer who for the past three years has been examining patent applications on lubricating compositions and lubricating oil additives for the U. S. Patent Office.

Exclusive in the October TECHNICAL SECTION of National Petroleum News.

### Use of Cast Iron For Corrosive Service

Extensive data are presented on the corrosion rates of cast iron exposed to the action of substances commonly handled in the petroleum refining and chemical processing industries. Factors dictating the choice of cast irons for corrosive service, the availability of the material, design for chemical industry equipment, and specific applications are discussed. Results of laboratory and plant tests with many corrosive media are shown; appended tables list many chemicals regularly handled by cast iron pumps and valves, and those resisted satisfactorily by high silicon iron.

The author is in charge of corrosion engineering with a large metal company.

### Methods of Repairing Refinery Process Equipment

Any methods used for repairing refinery process equipment should develop a strength at least equal to that required for the operating conditions encountered. Care should be taken that the repair does not cause weakening of other parts of the equipment being repaired, and does not set up internal stresses in the equipment. Makeshift or temporary repairs should never be made when there is any possibility that failure would result in a fire or personal injury.

Some of the more common methods of repair that are usually encountered in the course of inspections are discussed in the fourth installment of the PAW Refinery Inspection Manual, in the October issue of the TECHNICAL SECTION.

# POST WAR CAR FOR MILLIONS OF AMERICANS

**Let's imagine it's the day after V-J Day.**

Millions of American families who've patriotically suppressed their desire to go places during wartime are now anxious to be out on the road again.

But many of these families won't have a car of their own for some time to come, for thousands of cars will have gone out of service, and it may take years to replace them.

Won't it be only natural then for many travel-hungry Americans to turn to the buses that have served them so well during the war years? Furthermore, other millions of men, women and children will continue to rely on buses for daily transportation—to work, to school, for shopping and visiting.

Thus the bus operator's postwar job may become bigger and more difficult than ever. However, there's one factor that will tend to make things somewhat easier. That is the better gasoline that will be available. (Today the best gasoline—improved with Ethyl fluid—is still fighting.)

We of Ethyl look forward to helping the bus industry make the best use of this better gasoline certain to come. We hope, through the continuation of cooperative research and service activities, to contribute to the improvement of engines, fuels and motor transportation itself.

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# First 3-Coil Thermal Cracking Unit in U. S. Goes on Stream at Sunray Refinery

## Three Furnaces (for Light, Heavy and Intermediate Feed Stocks) Permit Greater Flexibility in Operations. Temperature and Pressure Can Be Independently Controlled in Each Coil

ONE of the first known installations of triple-coil thermal cracking in the United States has gone on stream at Sunray Oil Co.'s Allen, Okla. refinery. The only other known installation is in a refinery at Curacao, N. W. I.

An interesting advantage of three-coil operation is the amount of flexibility it permits. Temperature and pressure in each furnace can be regulated to permit Sunray to produce different quality of products from varying charge stocks as conditions demand.

The Sunray unit is not entirely a "new" installation. A two-coil unit has been in operation for about eight years and it is to this existing facility that the third coil has been added. According to officials, considerations involved in the plant expansion were mainly an increase in refining capacity and flexibility in operations.

However, design calculations demonstrated that output of the new coil would overload other existing items of equipment as well as certain plant utilities. Hence it became necessary to increase fractionating and stabilizing facilities, enlarge the gasoline treating plant, add a new hot-oil pump and increase electric generating and water cooling capacity. Cost of the alterations has been placed at approximately $500,000.

Secondary considerations in the project, in addition to boosting cracking capacity from 4500 b/d to the new figure of 7500 b/d, were probable over-all increase in octane number of gasoline and greater efficiency in utilization of the $C_5$ and $C_4$ hydrocarbons. To attain the latter end, a depropanizer is being installed which will separate all the $C_4$ fraction and a large portion, if not all, of the $C_3$'s to operate the polymer plant at full capacity. Before the 100-octane cutback was announced it was the intention to segregate some of the butane-butene fraction for codimer manufacture, the balance going to nearby refineries operating alkylation units for feed stock.

What may be termed the "present" plant started operations in 1934 with the rebuilding of original skimming facilities and installation of a one-coil Dubbs cracking unit. There has been a refinery on this site since 1920.

A second cracking coil was installed in July 1937. Since this equipment still was in good shape it was decided to add a third coil to attain increased output and enhance octane number of gasoline produced rather than to install some of the newer catalytic processes. A second factor dictating this decision was that straightrun and cracked Allen and Beebe crudes, which constitute the bulk of the charging stock, is "freakish"; it inherently possesses a high lead susceptibility and good clear octane rating.

Currently the plant is producing motor fuel, a 72-octane straightrun naphtha for aviation gasoline blending, codimer, poly gasoline (from unsaturated $C_3$'s), and residual or No. 6 fuel oil. The straightrun aviation naphtha is being produced intermittently on the original topping equipment. At other times the raw crude is charged directly to the cracking unit with topping facilities remaining idle.

The new cracking installation is capable of charging a mixture of stocks ranging from 100% reduced crude to 100% virgin crude, depending on what is available in stock tanks or what is desired for some special purpose. At the present time the unit is operating on 67% raw crude and 33% topped crude (Table 1). The topped crude results from production of straightrun aviation naphtha.

Processing sequence is not unusual and, as in the more commonly encoun-

**General view of the Sunray refinery as it is today, showing the three-furnace setup which permits more flexible operation. Major equipment items shown are (L to R) new depropanizer, new stabilizer for pressure distillate, cracked gas absorber, old poly catalyst chamber and stabilizer (not now in use), fractionator columns for skimming plant, new poly unit and stabilizer. Behind the first furnace, which is the latest addition to the plant, is the distillation and reactor section of the Dubbs unit. At the right are the other two heaters for thermal cracking; the end one was erected in 1937, its mate in 1934**

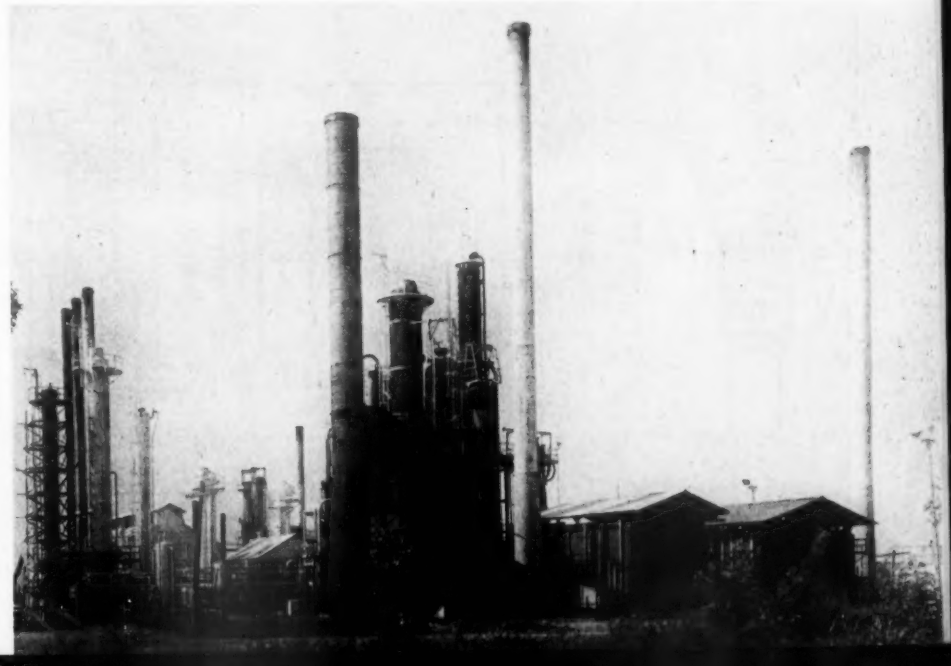


TABLE 1—Inspection Data on Cracking Unit Charge Streams

| | Charge To Unit* | Light Oil Feed | Intermediate Oil Feed | Heavy Oil Feed | Residual Fuel | Reduced Crude |
|---|---|---|---|---|---|---|
| Gravity, A.P.I. | 32.0 | 30.3 | 27.3 | 21.3 | 9.8 | 26.2 |
| Percent over at: | | | | | | |
| 375°F. | 19.0 | 4.5 | 0.3 | ... | ... | 0.5 |
| 400°F. | 21.0 | 7.5 | 3.5 | ... | ... | 1.0 |
| 437°F. | 24.0 | 22.0 | 7.0 | 0.5 | ... | 2.0 |
| 572°F. | 44.5 | ... | 76.0 | 28.0 | ... | 16.0 |
| 600°F. | 54.0 | ... | 86.0 | 38.0 | ... | 21.5 |
| 650°F. | ... | ... | ... | 50.0 | ... | 34.0 |
| Viscosity @ 122°F. | ... | ... | ... | ... | 130 | ... |
| Flash (P.M.) | ... | ... | ... | ... | 190 | ... |
| Pour Test | ... | ... | ... | ... | 30 | ... |
| B.S. & W., % | 0.3 | ... | ... | ... | 0.6 | ... |
| Color | Black | Straw | Dark Straw | Black | Black | Black |

*Mixed virgin crudes, 66.75%; cracked stock, 29.97%; recycle stock, 2.29%; slops, 0.99%; total, 100.00%.

ter-well take-off at mid-tower accumulates tered thermal units, output of the triple-coil cracking section may be considered to discharge into a reactor, a flash chamber (where residuals drop out) and, finally, into a fractionator producing pressure distillate (gasoline) as an overhead product. However, in this particular plant the flash tower has the dual functions of crude topping (preparing heavy cracking stock) and as a conventional flash chamber. Also, the fractionator prepares "light" and "intermediate" cracking stocks as well as separating cracked pressure distillate from these heavier fractions.

Interesting part of the whole arrangement, as previously pointed out, is the great flexibility permitted by use of the three cracking coils. Temperature and pressure — thereby severity of cracking — can be controlled in each coil at will to suit both the individual charge to be used and quality of product desired. Moreover, with 5000 b/d of separate topping facilities also available at need, including chemical desalting equipment, crude throughput can be boosted to 12,000 b/d, far beyond the nominal 7500 b/d capacity of the thermal cracking units.

### Processing Sequence

Before proceeding with a description of processing sequence, some detail of the several dual purpose items of equipment may be of interest (refer to Fig. 1).

The pressure distillate fractionator, an 8 x 67 ft column, operating at 60 psi, is divided into two sections by a take-off tray or well, the upper portion consisting of 16 conventional bubble decks and eight side-to-side trays, while the lower section has four bubble-trays. The center-well take-off at mid-tower accumulates light cracking stock while "intermediate" cracking stock collects at the bottom of the tower.

Overhead is pressure distillate, a part of which, after condensation, is returned to the tower as reflux. The balance is charged to another tower for stabilization to motor fuel specifications, where overhead is subsequently used for poly plant charge stock. Residue from this operation is used as plant fuel.

The flash chamber, operating at 105 psi, is an upright vessel of 8 x 46 ft, also divided into two sections by a take-off well. The upper section has eight side-to-side trays for preliminary fractionation of cracked vapors and is refluxed with incoming crude charge.

The two upright reactors are of conventional Dubbs design. No. 1 reactor is a vessel of 5 x 25 ft and operates at 300 psi, while No. 2 is 6 by 42 ft and operates at 250 psi. Bottoms from No. 1 discharge into the top of No. 2 which, in turn, discharges into the side of the flash chamber.

The two original furnaces are of end-fired design, functioning respectively as light oil and intermediate oil crackers. Each have 4-6% chromium, 0.5% molybdenum steel alloy tubing headers; radiant sections are of the same alloy. Balance of the tubing now is carbon steel but, as replacements become necessary, new tubes also will be alloy. The last furnace, added in the present expansion, is an all-alloy equipped heater of conventional Dubbs "upshot" design.

Charge is not desalted before entering

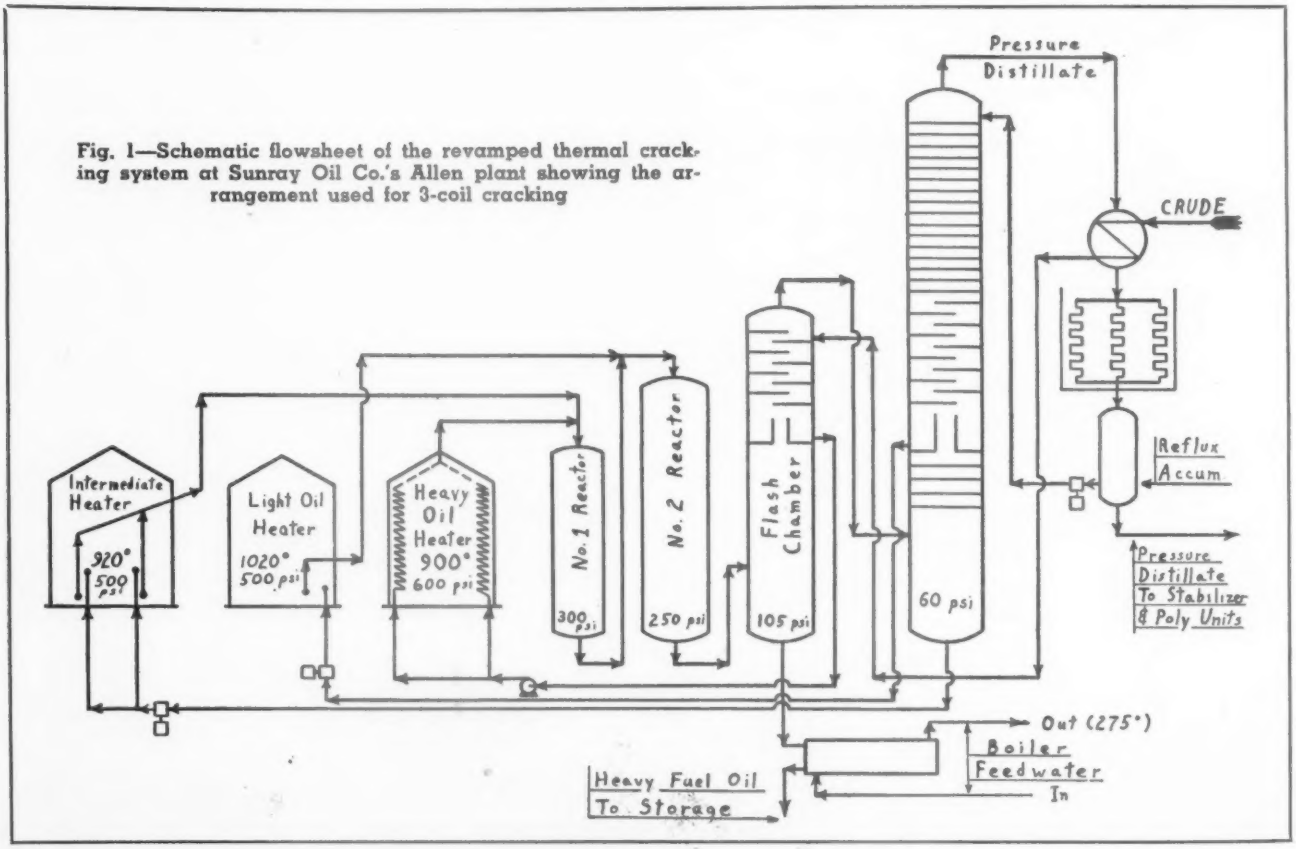



**Fig. 1—Schematic flowsheet of the revamped thermal cracking system at Sunray Oil Co.'s Allen plant showing the arrangement used for 3-coil cracking**

**TABLE 2**
Inspection of Stabilized Pressure Distillate

| Description | Pressure Distillate |
|---|---|
| Gravity, A.P.I. | 57.2 |
| Distillation, A.S.T.M.: | |
| I.B.P. | 98.0 |
| 10% | 146.0 |
| 20% | 176.0 |
| 30% | 206.0 |
| 40% | 238.0 |
| 50% | 268.0 |
| 60% | 296.0 |
| 70% | 326.0 |
| 80% | 358.0 |
| 90% | 374.0 |
| E.P. | 400.0 |
| % Recovered | 99.0 |
| Color | Lemon |
| Doctor Test | Positive |
| Corrosion | Negative |
| Reid Vapor Pressure, psi. | 5.5 |
| Octane No. (A.S.T.M.) | 63.5 |
| % Sulphur | 0.02 |

any of these furnaces; chemical desalting is used only in connection with the old topping unit.

Feed for thermal cracking is preheated to 180° F. in a pressure distillate-to-crude exchanger before entering the cracking unit flash chamber near its top. Here it serves as reflux and at the same time is effectively topped, its heavy ends accumulating in the well at mid-tower for draw off as heavy cracking stock while light ends go overhead for fractionation.

Heavy cracking stock — reduced crude — is picked up by a hot oil pump and charged to the new heavy-oil furnace whence it emerges at 905° F. and 600 psi. Cracked heavy oil then passes through two reactors in series flow, where pressure is reduced successively to 300 and 250 psi. Bottoms from the No. 2 reactor enter the previously - described flash chamber at its lower third, flashing at 105 psi pressure.

Bottoms from the flash chamber are a heavy residual fuel, while overhead its heavy pressure distillate for subsequent fractionation and further processing. Residuum is first cooled by exchange with boiler feed water, heating the latter to 275° F. This step reduces boiler load, since to reach the 125-lb steam pressure used in the plant requires the boiler to increase the water temperature less than 100° F. Final cooling of residuum to stock tank inlet temperature is completed by additional water-cooled heat exchangers.

Bottoms from the fractionator are charged to the intermediate oil furnace. Here temperature is raised to 920° F. and the oil emerges at 500 psi pressure to enter No. 1 reactor. There it mingles with the effluent from the heavy oil furnace for the processing previously described.

Light oil, accumulating from the central take-off of the fractionator, constitutes the charge to the light oil furnace. This light material emerges at 1020° F. and 500 psi to enter the top of No. 2 reactor, there comingling with the cracked oil from the other two furnaces for further processing. Laboratory inspection of the present charging stock as well as of other thermal unit streams is shown in Table 1. Inspection of stabilized pressure distillate is given in Table 2. Table 3 gives net plant yield data.

**TABLE 3**
Net Plant Yields Based on Charge*

| | |
|---|---|
| Pressure Distillate | 58.90% |
| Polymer | 0.60% |
| Codimer | 0.96% |
| Recycle Stock | 2.41% |
| Residual Fuel | 28.91% |
| Losses** | 8.22% |
| Total | 100.00% |

* Excludes aviation naphtha produced in topping operations.
** Includes tail gas to plant fuel.

### Topping Unit

Design of the 5000 b/d topping unit (Fig. 2) is not unusual. It consists of a two-coil furnace, two fractionation towers and two salt settlers. The dual arrangement is intended to permit simultaneous processing of two dissimilar crudes without mixture of their light products. Allen and Beebe are the two crudes normally charged to this unit, at identical rates of 2500 b/d. A description of the major equipment items is given in Table 4.

Referring to Fig. 2. Allen crude is charged through a crude-to-residuum exchanger, chemical is added, and the stream flows through No. 2 salt settler before entering one of the two coils of the heater. Heated to 600° F. the crude next passes to the bottom of the 20-tray No. 2 fractionator, where about 300 b/d of 72-octane aviation naphtha are taken

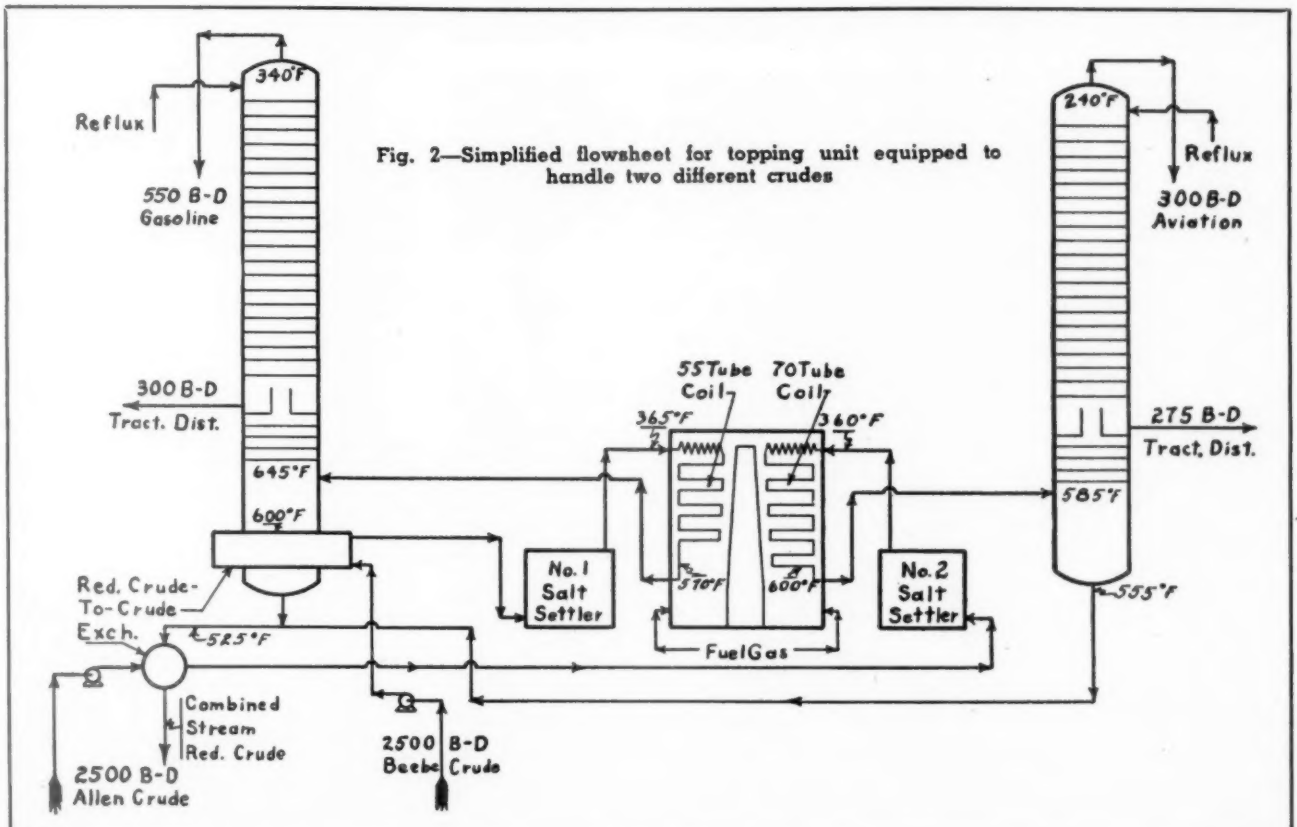
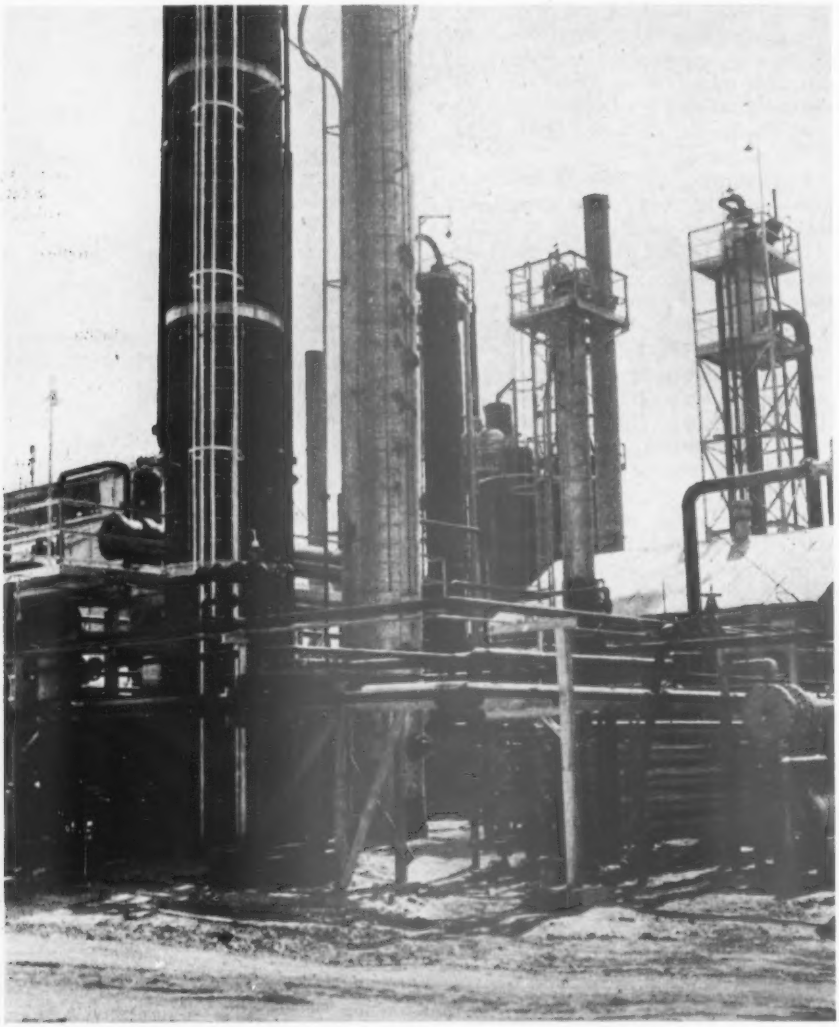



**Fig. 2—Simplified flowsheet for topping unit equipped to handle two different crudes**



**Close-up of cracked gas recovery system. Two towers at left are the new stabilizer and absorber; next to them are an old fractionator column, the codimer (poly gasoline) stabilizers and catalyst chamber, and barometric condenser for new hot oil pump. The heat exchanger bank for pressure distillate is in the foreground**

overhead. A similar amount of kerosene or tractor distillate is taken off as a side cut, and reduced crude is withdrawn as bottoms. Bottoms, as residuum, return to the exchanger originally used to preheat the charge before flowing to stock tanks.

Beebe crude is preheated by exchange with the bottoms of No. 1 fractionator, chemically desalted and settled, and then passes to the second of the heater's two coils. This stream emerges from the heater at 670° F. to enter No. 1 fractionator. As in No. 2 fractionator, three streams are taken from No. 1—gasoline, tractor distillate, and residuum. Residuum joins the stream from No. 2 column to pass through the residuum-to-Allen crude exchanger before going to storage as reduced crude for cracking.

Overhead vapor from the cracked gasoline stabilizer consists largely of $C_1$ through $C_4$ hydrocarbons. Originally it was the practice to charge these gases through a phosphoric acid (Dubbs) polymerizing unit, from which the olefin content was recovered as poly gasoline. The $C_3$ and $C_4$ paraffins plus methane, ethane and ethylene in the tail gas were utilized as plant fuel.

When the demand for 100-octane blending agents became urgent, the poly unit was converted to codimer manufacture. Later, it was revamped by addition of another catalyst case which permitted polymerization of propylene by using a higher catalyst bed temperature than in the reactors converting butylenes into codimer.

However, when the 3-coil cracker modification was designed, it was realized existing polymerization capacity would be entirely inadequate to process all of the $C_3$-$C_4$'s which would be produced. Plans then called for the installation of a 3-ft I. D. x 51 ft depropanizer containing 28 bubble-decks, which would segregate a B-B cut from stabilizer overhead. Sufficient B-B then would be diverted from this stream to operate poly capacity at maximum codimer output, with the balance of the $C_4$'s available for shipment to nearby refineries possessing alkylation facilities. Cut-back in 100-octane requirements, announced in July by PAW, left the company with a depropanizer on its hands.

Plan now is to use the depropanizer, designed for 350° F. at 325 psi, for a stream splitter as originally intended. However, it now will split out all of the $C_4$ fraction, and sufficient of the $C_3$ olefins as well to assure operation of poly facilities at maximum capacity for codimer. When codimer no longer is needed in 100-octane manufacture the unit will be reconverted to poly gasoline production. The $C_1$-$C_2$ fraction in the splitter overhead will be augmented by the balance (if any) of the $C_3$ cut and charged to plant fuel gas. The amount of $C_3$'s thus rejected will be determined from actual operational requirements and will depend in part on severity of cracking as well as demand of the poly unit.

### Postwar Operations

It is interesting to speculate on the possible output of this plant now that peace has come. Crude sources in all likelihood will be the same. The major component will be Allen crude, with probably Beebe crude constituting most of the balance, together with a comparatively small amount of crudes from the Fittstown, Madill and Cromwell pools of central Oklahoma.

It is estimated that if all poly gasoline and the 72-octane straightrun are mixed with the thermally cracked gasoline, and enough natural gasoline (Grade 26-70 or "stabilized" grade) added to meet boiling range requirements, the resulting product will test 85-octane (A. S. T. M.) with 3 cc tetraethyl lead.

If the most susceptible fractions of the plant's gasoline output are segregated and leaded, a respectable quantity of 91-octane aviation gasoline will not be out of economic reach, plus the present line of "premium" and "housebrand" grades of motor fuel. Some form of catalytic cracking or perhaps hydroforming may be installed in place of present topping facilities or as additional equipment to further enhance the quality of Sunray's products.

**TABLE 4—Topping Unit Equipment**

| Item | Description |
|---|---|
| Furnace | Two coil, end-fired with gas. |
| Furnace Coil No. 1 | 55 carbon steel tubes; temperature inlet 365°F.; outlet 670°F.; capacity 2500 b/d |
| Furnace Coil No. 2 | 70 carbon steel tubes; temperature inlet 320°F., outlet 600°F.; capacity 2500 b/d. |
| No. 1 Fractionator | 6 x 60 ft. column, 20 trays. Temperature: inlet 645°F., bottoms 600°F., overhead 340°F. Make: 550 b/d gasoline, 300 b/d tractor distillate, 1650 b/d reduced crude losses. |
| No. 2 Fractionator | 6 x 57 ft. column, 20 trays. Temperatures: inlet 585°F., bottoms 555°F., overhead 285°F. Make: 300 b/d aviation naphtha, 275 b/d tractor distillate, 1925 b/d reduced crude and losses. |

# Scientists Complete Study of Failure of East Ohio Gas Co.'s Liquid Storage Plant

*By E. R. McCarthy*

**After nine months of investigation, three scientists have completed a study of all technical phases of the failure on October 20, 1944, of the natural gas liquefaction and storage plant of the East Ohio Gas Co. in Cleveland. The committee was appointed by the mayor of Cleveland, and included George E. Barnes, Kenneth H. Donaldson and Mathew M. Braidech, all of the faculty of Case School of Applied Science.**

**Natural gas was stored at the plant in liquid form at —260° F. in four insulated holders, three spherical and one cylindrical. The cylindrical tank failed first, according to the investigators, and resulted in the subsequent fire and explosion. Exactly what caused the failure, however, the investigators said could not be determined.**

**The principal portions of the report resulting from this study and the findings of the committee are presented below. An earlier story in National Petroleum News (Aug. 1, 1945, pg. 13) gave additional details and conclusions.**

THE Liquefaction, Storage and Regasification plant which the East Ohio Gas Co. put into operation at their No. 2 Works early in 1941 was the first of its kind to be used for the storage of liquid natural gas.

Its use seemed to be the answer to the problem of accumulating reserve capacity at load centers which, in the case of Cleveland, were in the congested industrial areas. The fact that the plant operated satisfactorily for more than three years before the disaster vindicates the judgment of the owners. The thoroughness of the investigation, however, reveals many details which can and will be checked more carefully in the future.

As has been pointed out in the report, the blame must be shared by the company with the municipal and state authorities. Criticism was leveled at the company for the failure to supervise some of the details of construction which investigation has shown may have been contributing causes of the disaster and at the municipal authorities for failure to recognize and enact legislation to cover this potential danger of such an installation.

All existing ordinances were complied with and all codes covering the operations of similar plants were followed as far as possible but in many cases the approval was negative, in the form of a statement that the existing codes did not apply to that type of installation.

The destroyed L. S. and R. (as it is designated in the report) was built as the result of studies made at a pilot plant put into operation by the Hope Gas Co. at Corton, West Virginia, in 1937.

### Technical Difficulties Overcome

After six months of service several technical problems presented themselves and required solution before completely successful operation of the pilot plant could be obtained.

The first of these was the discovery that the raw gas had to be purified and dried before it was liquefied in order to prevent freezing in the lines and the entraining of those inert components which could not be liquefied at the ordinary process temperatures.

The second problem was one of insulation. Sheet cork was finally settled upon as the most suitable both from the thermal and structural standpoint.

The third difficulty to be encountered and the one which may have had some bearing on the disaster, was the properties of the material used to contain the liquefied gas. Ordinary steel became too brittle at the sub-zero temperature and an alloy of .09% carbon and 3.5% nickel was finally settled upon. With this experience in back of them the East Ohio engineers planned the construction of the L. S. and R. plant.

The process of liquefying gas is not new. During World War I, helium was separated from natural gas by this means. The East Ohio plant consisted essentially of gas engine driven compressors to handle the raw gas and the refrigerants; purification apparatus, the storage tanks and the regasification unit.

Raw gas at 30 lb. pressure was taken

**Aerial view of the demolished area immediately after the disastrous East Ohio Gas Co. explosion and fire last October. "A"—cylindrical tank No. 4, the one which apparently failed first; "B"—sump; "C", "D" and "E"—spherical tanks, one of which failed; "F"—ethylene storage tanks; "G"—cooling tower; "H"—compressor building; "I"—gas holder; "J"—buildings on company property**

*This article originally appeared in the Aug. 2 and Aug. 9 issues of "Cleveland Engineering," weekly publication of the Cleveland Technical Societies Council, of which Mr. McCarthy, the author, is editor. Mr. McCarthy is also associated with the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., as Cleveland District Manager.*

from the incoming mains and compressed in two stages to approximately 600 lbs. gage. From the compressor it passed through the purifiers to the cascade refrigeration system and was cooled partially by ethylene and partially by expansion to about −250° F. It was then in liquid form and passed direct to the storage tanks.

In the regasification process the liquid was pumped from the bottom of the tank to heat exchangers where it was warmed and then vaporized before passing into the 30 lb. mains. The entire contents of the storage tanks could be vaporized and passed into the mains for consumption in about 50 hours.

The consultants made a thorough examination of all the machinery and piping of the plant and with the exception of minor details and the omission of items which might have increased the safety of operation, nothing was found that would have caused the disaster.

All safety rules and regulations had apparently been observed and all dangers connected with the operation of high pressure machinery and the handling of natural gas had been guarded against.

### 260 Billion BTU's in Storage

The great amount of destruction at the site of the plant can be easily understood when one realizes the potential energy in the stored gas. The consultants calculated that the latent energy in the form of the thermal value of the liquid was in the order of 260 billion BTUs.

Half of this was contained in the tanks that failed and dissipated their contents during the first two hours of the fire. This was at the rate of 25,000,000 hp., a figure comparable to the capacity of all the hydro-electric plants west of the Mississippi.

They have used this example as a basis for their argument that codes should be established to take into consideration not only the total amount of energy stored in a locality but also the possible rate of dissipation.

The evidence gathered in the exhaustive search and study which the consultants made after the disaster, points almost conclusively to the structural failure of cylindrical tank No. 4 as the starting point of the destructive train of events which took over 100 lives and destroyed some $6,000,000 worth of property, within a few hours. The exact cause of this failure is not certain.

A reconstruction of the afternoon's events as obtained from the testimony of witnesses and the analysis of the wreckage seems to indicate that the collapse of tank No. 4 was responsible for the destruction of the supporting columns and the consequent failure of tank No. 3.

The liquid gas had saturated the rock wool insulation of No. 4 and the explosion had scattered it in all directions, setting numerous fires among the wooden structures in the vicinity.

What liquid did not evaporate ran into sewers and conduits, forming explosive mixtures which in turn blasted the neighborhood and spread the flames.

The fragments of No. 4 tank were scattered over a wide area. In order to reconstruct the tank in an effort to determine the cause of the failure, the consultants aided by a survey party collected some 2000 pieces ranging in length from several feet to a few inches. These were all cataloged as to their location in the original structures, and independent physical tests as well as chemical analyses were made on the most important ones.

The selection of the cylindrical or torro-segmental design of tank in place of the proven spherical design, was made for economy reasons and on account of the inability to obtain proper materials. This was only done after assurance had been given by the contractor and consulting engineer that the design would be safe.

The inner tank, where structural failure first occurred, was formed of 3.5% nickel steel plates of thickness varying from .250 to .500 in. These were butt welded to form the walls of the tank with a 25% chromium and 20% nickel rod.

At the top the roof support was formed of a continuous T section belt ring, 12 in. x 1 in. vertical and 10 in. x 1½ in. horizontal. A similar belt ring 18 in. x 1¾ in. vertical and 12 in. x 3 in. horizontal formed the lower base of the tank wall and acted as the support for the floor.

The tank load was transmitted through the lower belt ring to a 10 in. x ½ in. base plate and then through 1¼ in. rocker plates to 60 wooden posts 8 in. x 8 in. braced circumferentially to permit radial movement of the expanding tank. The lower ends of the posts transferred the load through rocker plates and the outer tank bottom to the concrete foundation. Wood was used in place of steel to prevent the flow of heat to the inner tank.

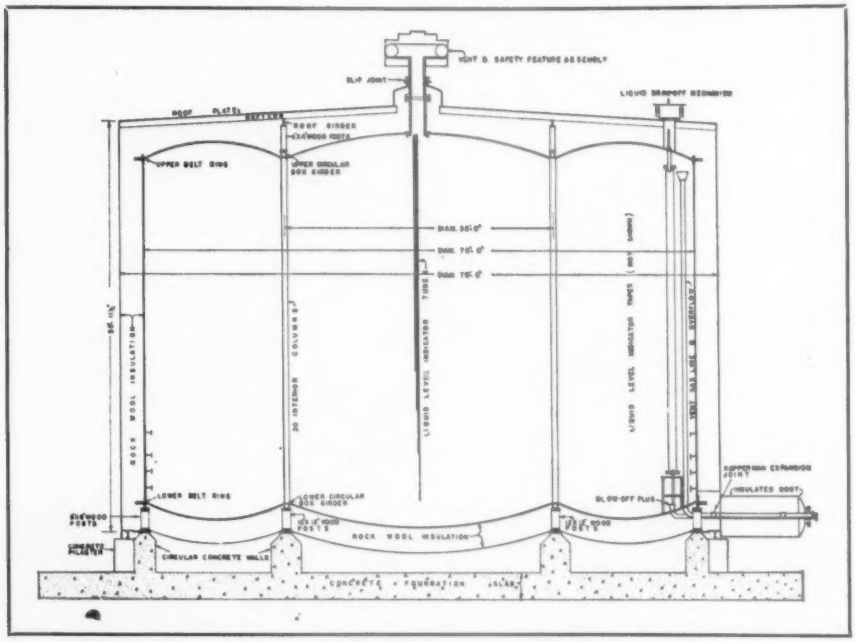
The outer roof and also the inner roof plates along the circumferential line where the spherical and torroidal surfaces intersect were carried on 30 fabricated H section columns 12 in. x 5/16 in. web and 12 in. x ⅜ in. flange. At the top of these columns was a continuous box girder with 8 in. x ⅜ in. webs and 11 in. x ⅜ in. flanges.

The roof load was transmitted through a continuous 8 in. channel girder and 20 wooden posts 4 in. x 4 in. to the box girder on the vertical columns. The lower flanges of the box girder carried the roof plates of the inner shell.

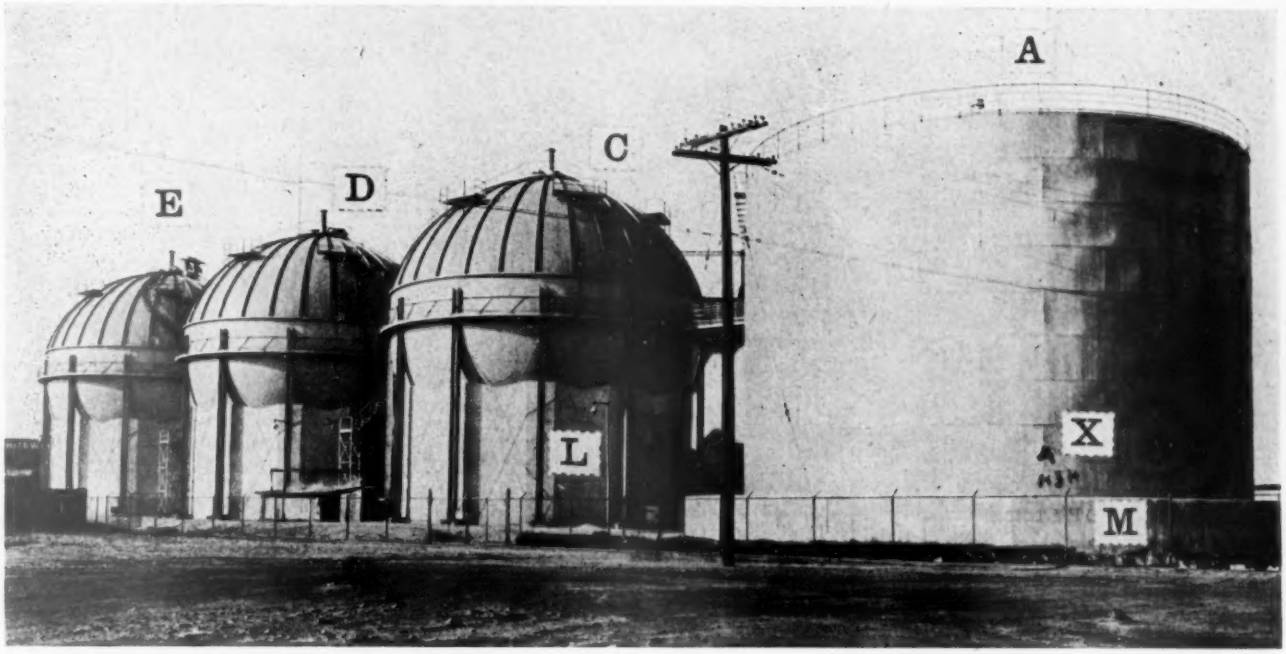
The vertical columns rested on a lower continuous box girder with 8 in. x ½ in. webs and 14 in. x ½ in. and 14 in. x ¾ in. flanges. The floor plates of the inner shell were welded to the upper (14 in. x ¾ in.) flanges of this girder.

Thirty wooden posts 12 in. x 12 in. with metal end and rocker plates transmitted the load from the lower box girder through the floor plates of the outer tank to the concrete foundation. These posts were concentric with the 60 posts supporting the wall of the outer tank and were arranged with circumferential bracing to permit radial movement of the inner tank.

The side walls, roof and bottom of the




**Design details of the cylindrical (toro-segmental) type of storage tank, the latest one built and apparently the one which failed first**




**Four tanks were used for storing the liquefied natural gas at —260°F.—three spherical ("C", "D" and "E") and one cylindrical ("A"). Curtain walls "L" were added to the spheres, and a dike wall "M" built around tank 4. Point "X" is where witnesses reported seeing vapors emerging prior to the explosion and fire**

outer tank were fabricated of structural steel and the conical roof was stiffened with 8 in. channel rafters which rested on the tank side wall and upon the channel girder atop the vertical members.

The inner tank wall was stiffened with T-shaped circumferential rings for some distance above the floor in order to provide additional strength against the inward thrust of the insulation.

The uncertain nature of the soil structure made it necessary to employ a reinforced concrete mat 95 ft. square and 38 in. thick with concentric supporting walls to take the tank loads. This was designed for the total load of the filled tank and liberal allowance was made for the possibility of a simultaneous snow and wind load.

After the fire the levels of this foundation mat were checked and found to be well within the original values, thus indicating only slight settling.

### Stresses Checked

A study of the design and a review of the calculations for tank No. 4 reveal that only tensile and compressive stresses were considered in the walls. These calculations were checked by the consultants and the unit stress in the material was found to be well within the safe limits in those parts of the structure where there was no discontinuity and assuming normal operating temperatures.

Information on the behavior of metal at temperatures in the region of —250° F. is not too complete at the present time and the tank designers arbitrarily and safely assumed that the A.S.M.E. code permitting the use of 3.5% nickel steel for pressure vessels at —150° F. would apply to a tank at atmospheric pressure and —250° F.

The design of the inner tank, however, presents two critical points where stress might become dangerously high and where the combination of stress, brittleness and shock might cause failure. The first of these places is the junction of the vent assembly with the inner roof; the second, the outer corner of the inner tank bottom.

The vent assembly of No. 4 tank weighed in excess of 6500 lbs. and was supported at a reinforced opening 30 in. in diameter by the roof of the inner tank. From the structural standpoint this assembly was too complicated to permit an accurate stress analysis and the best the consultants could do was to analyze the individual portions.

The stress of the vertical stiffeners in shear was found to be very low and the compressive stress of the spherical plates of the tank roof, which was partially balanced by the tensile stress from the internal vapor pressure, was also within the safe limits for a static load.

It was impossible, however, to determine the effect of stress concentration, low temperature brittleness or shock in this assembly and any one or a combination of all of these factors might have resulted in the structural failure.

Calculations were made for the junction of the inner vertical tank wall and the lower belt ring. At this point the belt ring is in compression from the radial pull of the floor plates and the vertical plate is already in tension. The combined stresses set up a bending moment in the wall plates and the calculation of this stress shows that it was quite high but within the safe limits for operation at normal temperatures where the elasticity of the system would permit a redistribution of the stress.

### Tank Reconstructed from Fragments

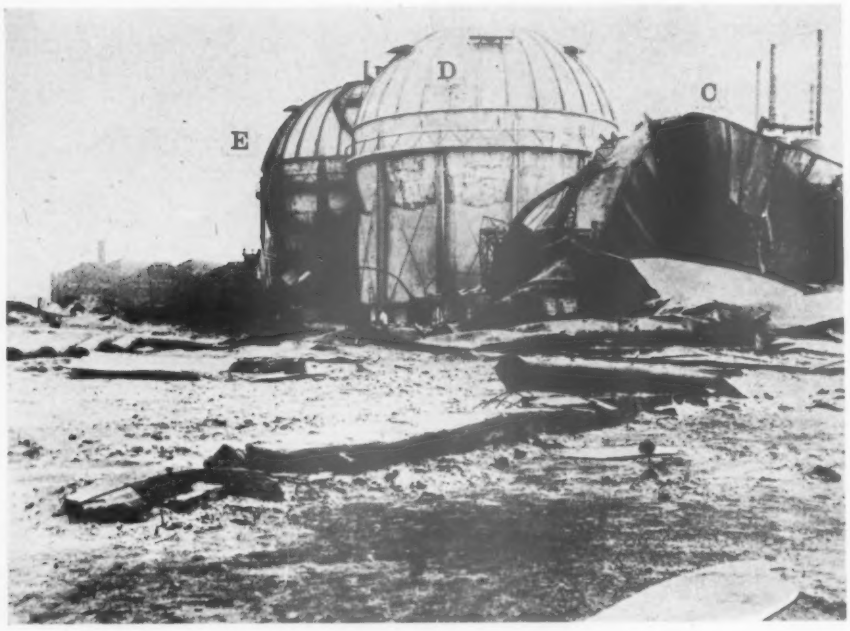
In order to study the progress of the failure of No. 4 tank, the fragments were gathered together and the top and bottom of the inner tank reconstructed. Most of the pieces showed smooth, even fractures similar in pattern to the brittle break of glass, a clear indication of brittleness at the time of failure.

The complete destruction of the tank itself and the violence with which the metal was shattered prevents a definite statement concerning the point of failure but the evidence is sufficiently substantial to justify the conclusion that the initial break occurred at the top center of the inner shell, travelled radially to the side wall, then downward to the tank bottom, and finally inward to the center.

The chart of the liquid level gauge for this tank shows that the contents were dumped almost instantly, an indication that the tank collapsed immediately after the initial break.

The exact cause of this structural failure will probably remain a mystery since the completeness of the wreckage and the length of time consumed in gathering the fragments together destroyed evidence that might have been pertinent to the study. There are, however, some theories that have been advanced based on an analysis of operating conditions.

Shortly after the disaster the opinion was expressed that the vibrations in the area might have caused a crystallization




**Only one of the three spherical tanks failed during the disaster—"C". The other two, "D" and "E" were still intact and filled with liquid gas after the fire. This liquid was quickly gasified and removed into the city mains to prevent further hazards**

of the metal and resulted in the ultimate failure of the tank.

Studies of these conditions do not support this theory. The maximum amplitude of the vibrations resulting from the passage of trains or the operation of machinery was not sufficient to cause an eventual crystallization of the metal nor to produce an impulse sufficient to simulate shock loading, either condition of which might result in failure.

There is still the remote possibility that some of these vibrations were close to the natural frequencies of the wrecked structures and that vibrations and stresses of large magnitude were built up through resonance to result in final failure. This possibility is extremely remote and in the opinion of the consultants does not justify any further study along those lines.

The maximum amplitude of the vibration at the site was obtained by dropping half a brick through a distance of 5 feet, 20 feet from the meter. This was almost twice the amplitude of any normal vibration in the area.

A second opinion expressed the possibility of "shock loading" either from an external or internal source. A counterweighted valve on top of the tank could be raised by hand and, despite the presence of a dashpot to cushion the closing, the valve could be "slammed" shut and this shock transmitted to the tank structure.

An internal disturbance such as the violent boiling of the liquid in the tank would produce the same effect. Natural gas is a compound of many hydrocarbons, all with varying boiling points. In storage, those with the lowest boiling point will tend to vaporize first. This would also be aided by localized spots in the tank where the heat transfer from outside would be higher by reason of a defect in the insulation or the presence of a support.

The formation of a gas pocket at that point would generate sufficient pressure to break through the layers of liquid and to transmit a sudden shock to the walls of the tank by the consequent overturn of the contents.

This may go on for some time before any harm is done but in the case of a tank operating under abnormally low temperatures, the sudden shock might be the cause of the metal failing. The remedy for this would be the continual stirring of the liquid gas to prevent formation of such localized pockets.

### Primary Cause Not Determined

Although the report goes into great detail in its analysis of all the conditions which were present at the time of the disaster, no definite statement has been made concerning the primary cause.

Some conclusions have been drawn and will probably be the most valuable portions of the report. The first has to do with the tank design. The strength of the spherical design was clearly demonstrated by the survival of No. 1 and No. 2 tanks even in the midst of the fire. This design had the advantage of continuity and the consequent absence of points of localized stresses.

In the case of the spherical tanks, the inner shell was cushioned against shock at all points by sheet cork insulation between the inner and outer shells. The cylindrical tank, however, used rockwool.

In the opinion of the consultants, the uncertainty regarding the behavior of metals at extreme low temperatures, made this change in design a risk that should have been avoided. The contractor, however, made this change for good and sufficient reasons and the disastrous outcome cannot be charged against him.

Existing building codes were not sufficiently comprehensive to cover a plant of this type and the result was negative permission in many cases, which meant that no regulation was being violated. The consultants report that more care should be given in the future to the writing of codes that pertain to the storage of potentially dangerous materials and that account should be taken not only of the energy involved but also the possible rate of dissipation in case of explosion or fire.

### Some Safeguards Overlooked

While it is quite evident that great care was exercised by the company in safeguarding the operation of the plant and in installing all known devices to prevent explosions, it is likewise true that some of the most obvious safeguards were overlooked.

The congested location of the site made safe distances between tanks impossible. If this had been done, it is quite likely that tank No. 3 could have been saved and the consequent damage reduced.

Inadequate dikes permitted the released liquid to overflow and the lack of traps at the sewer entrances permitted the evaporating liquid to dissipate through long lengths of sewers and conduits where, mixing with the air, it found explosive mixtures at points several hundred feet away. This aided the spread of the flames and increased the damage in outlying areas.

While space may not have been available for safe distances to be established, an adequate system of dykes, retaining walls and fireproof supports on No. 3 tank were possible at the site. The absence of these were all contributing causes to a disaster whose primary cause may never be known.

This report of the technical consultants contains over 120 pages of descriptive material, testimony and calculations as well as some 44 illustrations and drawings. Space did not permit us to do more than to give these brief extracts containing the salient points of the study and the portions which would be of interest to engineers contemplating construction or operation of similar plants.

The circulation of this report is restricted. Readers interested in having more detailed information on the disaster may write direct to Professor George E. Barnes at Case School of Applied Science, 10900 Euclid Ave., Cleveland 6, Ohio.

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# New Chrome Plating Method Boosts Life of Engine Parts

## "Porus-Krome" Process Produces Surface Filled with Pockets and Channels which Retain Lubricant and Overcome Chromium's Usual Lack of Wettability

*By D. P. Thornton, Jr.*
*Assistant Editor, NPN Technical Section*

A NEW method of applying chrome plating to cylinders or liners, rings, bearings, and other moving parts of all types of engines and pumps promises to go far in reducing maintenance costs of these equipment items, according to recent reports.

In the past, chrome plating for high speed applications involving close clearances was not satisfactory due to the fact that chromium is not wetted by the lubricants required; hence the plated parts failed sooner than if left unplated.

The new process, developed in Europe by Hendrik Van der Horst and now used and licensed by the Van der Horst Corp. of America, is called "Porus-Krome" to distinguish it from ordinary plating with chromium which presents a dense, nonporous surface after honing or polishing. It also has been described as "chrome-harding".

Essentially, the process consists of conventionally electrodepositing the metal, followed by a short stripping (etching) period which removes some of the coating in depth rather than in layers. The part then is honed to finish requirements. This stripping is the heart of the process, since the pockets and channels it produces remain after honing to serve as reservoirs for the lubricant and to give the surface that property toward lubricating oil called "wettability."

The porous surface of the plated chromium produced by the Van der Horst process is not particularly impressive to the naked eye. It has a "frosty" matte-gray appearance, not at all like the mirror-brightness ordinarily associated with chrome plating. Examined under the microscope, the thousands of pits or channels (both types of surfaces may be produced at will) look "ghastly" to the lubrication engineer accustomed to highly polished surfaces. Yet tests show the surface possesses all the characteristics associated with chromium, plus the imparted ability to retain lubrication, and will greatly increase resistance to wear and corrosion.

The character of the porous surface, that is, channel- or pocket-type pores, is determined by the stripping conditions—time, composition of bath and current density. These conditions also control the depth of pockets or channels. At the present time, the pocket-type porosity is being used on all engines except aircraft. Experience so far, however, indicates the channel-type porosity to be preferable for high speed, high output gasoline engines.

### Process Details

In commercial operation, conditions of the plating process and specifications for the work to be plated are necessarily precise, especially so when compared to usual plating procedure. The part must be dimensionally accurate with allowance for the finished deposit of chromium (usually 0.005 to 0.015 in. on diameter), and a surface smoothness of 10 microinches rms or less is desirable. This accuracy is particularly important since at best the plating can do no more than add a uniform thickness of chromium to the existing surface. Then, too, the plated surface must be honed in such a manner that desired porosity is exhibited and simultaneously meet final dimensional requirements and specified thickness of plating.

Smoothness is required because plating tends to exaggerate initial surface irregularities. Because of this property, according to Pyles[1], the process eliminates the necessity for magnaflux checking—cracks invisible to the eye are readily apparent after plating. Also, a definitely calculable surface area is required in determining plating conditions. Time, temperature, current density and bath composition, the other factors affecting the deposit, can be controlled for optimum results; surface area, however, is inherent in the item which is to be plated.

The plating anode, a half-inch thick cast sheath of lead-antimony alloy on a steel core, is specially constructed and machined accurately for the job at hand. An anode used for plating Diesel cylinder liners is about 1 in. smaller on the diameter than the inside diameter of the liner itself, and is machine-tapered to compensate for the tendency of the deposit to become thicker on the end of the cylinder down in the solution.

A jig is required to maintain exact

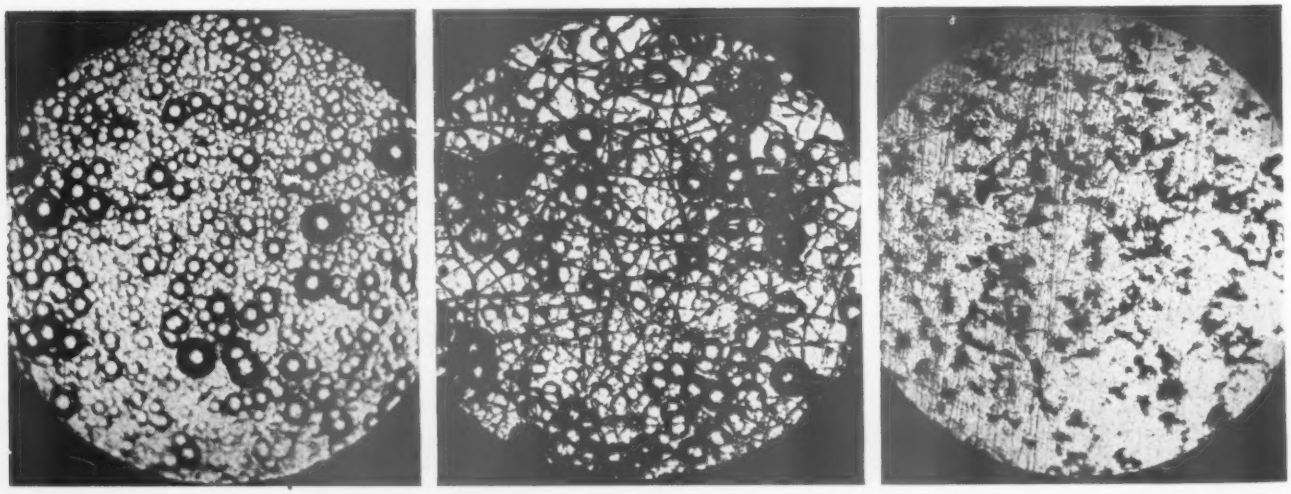


**Fig. 1—Photomicrographs (100X) of dense chromium deposit as used on a cylinder wall or liner. Fig. 1-a (left)—unetched surface of dense plated chromium. Fig. 1-b (center)— etched surface, but not honed. Fig. 1-c (right)—surface both etched and honed. About 30% of the finished surface is dotted with small pits or channels, which serve to retain lubricants**

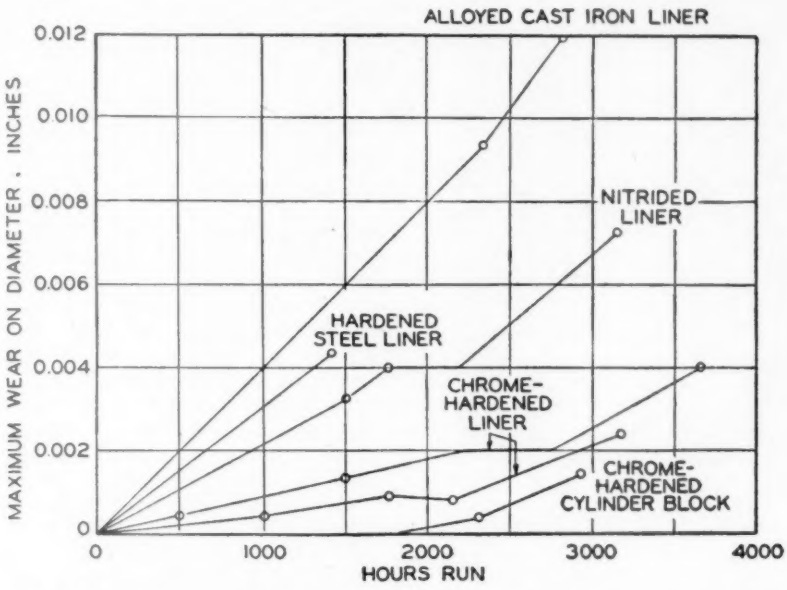



**Fig. 2—Wear comparison of porous chromium plated cylinder wall with common types of cylinder walls now in use.**

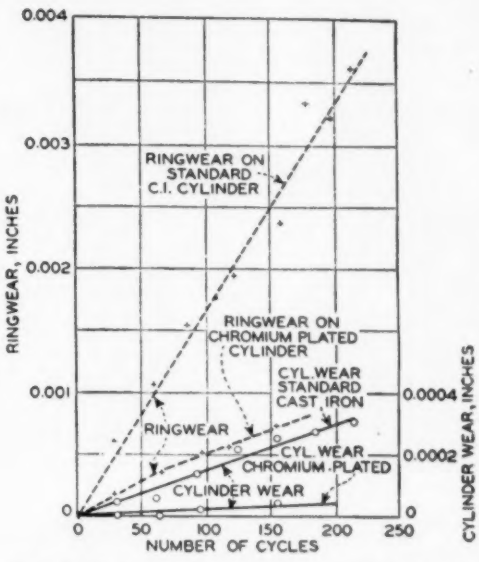



**Fig. 3—Cylinder wear test conducted by the Institution of Automobile Engineers (British). The operating cycle involves five minutes idling, 10 minutes under power, and 15 minutes cooling (to above 50° F.)**

centering of the anode with respect to the cylinder at all times, otherwise the deposit will not be uniform in thickness and even "treeing" may occur. To assure utmost rigidity, this fixture is quite massive. A jig to hold four 8½ by 22¼ in. Diesel engine liners weighs 2000 lbs, for example. The jig is electrically insulated from the anode but not from the work; utmost over-all cleanliness, careful assembly of connections, and good joints in busbars are required to prevent variation in current to the work. Each jig is powered by an individual 2500 amp rectifier to minimize complications from "stray" electric currents.

After plating is completed, the jig is moved to a second bath, where the etching or stripping which produces the porosity is done by reversing the current. The plated article is then cleaned and honed, the thickness of deposit being reduced generally by 0.002-0.003 in. Honing may be done conventionally, using the proper grit hones (90 to 500 grit).

This honing operation, on aircraft cylinders, is followed by blasting with a high-pressure air stream and water containing a fine abrasive. Final cleaning of all cylinders is with steam, and the article should be similarly re-cleaned before installation or use.

Inspection of the final surface, which should be from 20 to 50% porosity, is by microscopic estimation. This is accomplished by planimetering photomicrographs of various standard degrees of surface finishing, determining percent porosity, and then comparing the unknown surface with the calibrated photomicrographs, using 50-power right-angle microscopes.

Final dimensional tolerances on cylinder liners, as an example, are within the range −0 to +0.003 in. on the diameter, with out-of-round and taper held extremely close. Porosity is held within 20 to 50% of the surface area as a general rule, 30% being utilized for most work; it is practical to attain specified values with considerable accuracy.

### What the Surface Does

The advantages of hard chromium in withstanding severe wear and corrosion are quite well-known; it also has a low coefficient of friction. However, until Hendrik Van der Horst discovered how to make the surface "take" lubrication, its use was not feasible in high-speed internal combustion engines or other machines. If a deposit of dense chromium is examined microscopically, Fig. 1-a, a nodular surface will be revealed. If magnification is sufficiently great, cracks also will be observed.

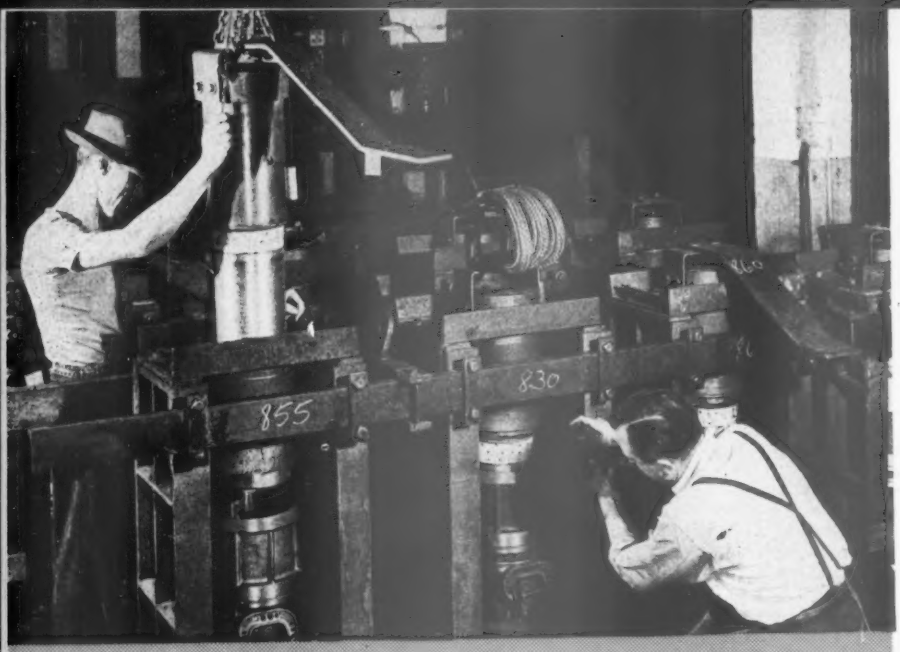
If this dense deposit then is partially stripped (plating current reversed for a short time) the deposit has the appearance of a coal pile, as seen in Fig. 1-b. The whole surface is broken up with cracks and plateaus appearing according to no definite system; it looks like the broken surface of coarse cast iron and feels rough to the touch. If reversing of the current is continued, the cracks will continue to grow until the entire deposit is removed.

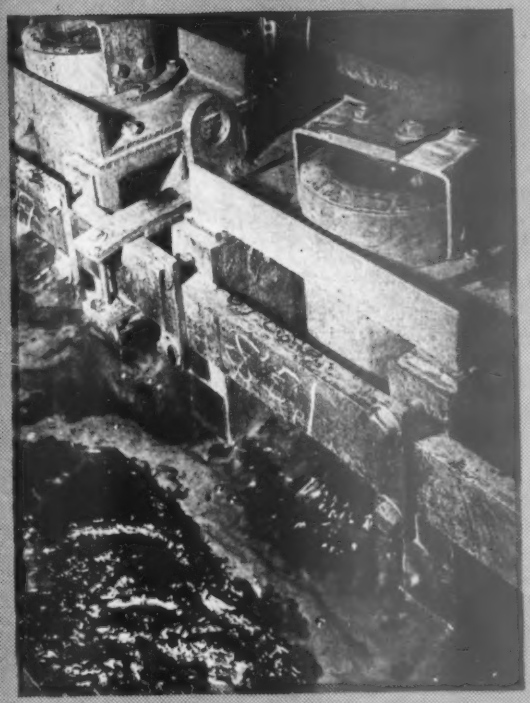
If, however, the surface in Fig. 1-b is honed, it will appear as shown in Fig. 1-c. There is seen a fairly smooth ordinary chromium surface dotted with a number of small pits, and it will be noted that these pits or channels do not extend to base metal. These pockets form excellent reservoirs for holding lubricant, and the deposit's ability to prevent corrosion from combustion products is unimpaired.

It can be demonstrated that the "pocketed" Porus-Krome surface is an actual aid in lubrication. According to Pyles[1, 2] and others, on a smooth, polished surface a drop of oil will reach an equilibrium state where it will neither spread further nor recede, and the edge of the drop will form a definite contact angle with the surface. If the surface is of porous chromium, however there will be a number of "pores" covered by the drop, with each of the infinite number of diameters through the drop encountering a different geometrical condition at the edge of the drop. Thus the equilibrium contact angle will never be reached at all points and the surface possesses "wetability."

The usual Porus-Krome deposit for cylinders of internal combustion engines has 30% of its surface taken up with pockets or channels, while 70% consists of "plateaus". According to Pyles' explanation, these plateaus of material having a low coefficient of friction, high heat transfer coefficient and a much higher melting point than steel or cast iron allow heat to be quickly dissipated from the surface into the body of the liner or block, thus reducing metal surface temperature in the combustion zone of the cylinder. There also will be a reduced tendency for heat generation (due in part to the broken surface, as reported by Teetor,[3]) and the high melting point of chromium also will function to raise maximum permissible surface operating temperature or discourage seizing of contacting surfaces.

The pores have still another valuable function. As the oil-control rings wipe the surface only, there is no possibility

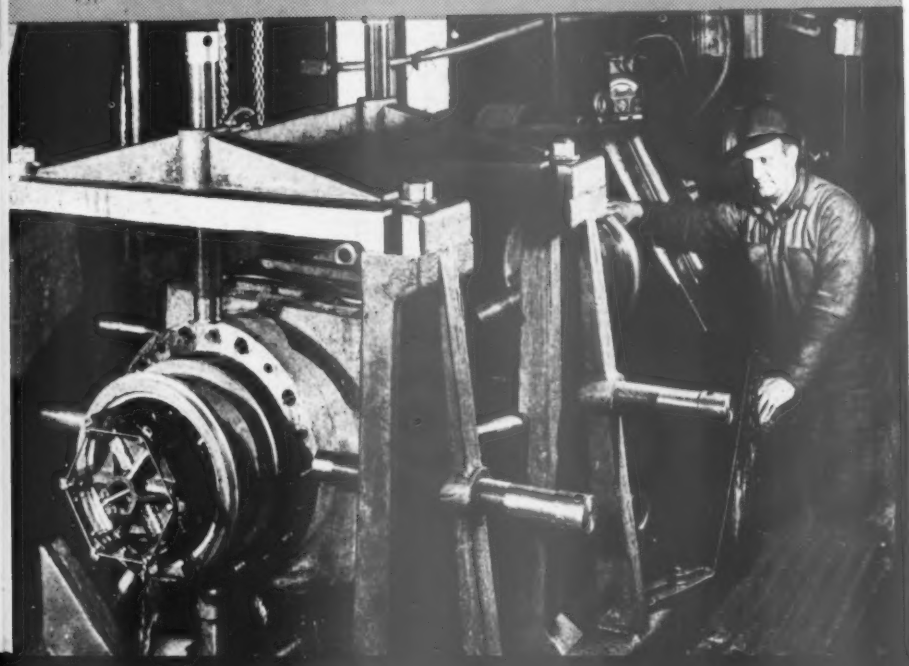


**ABOVE—Lowering anode into Diesel engine liner (already in jig). These jigs are necessary to insure exact centering of the anode; otherwise the plating may not be uniform.**

**LEFT—View of plating bath, showing how the jigs are immersed and the violent agitation of the liquid during plating.**

**BELOW — Final operation is honing, wherein 0.002 to 0.003 in. of chromium is removed from the plating to give the surface shown in Fig. 1-c**



of removing the oil from these pockets—plateaus only are affected. Hence, as soon as the rings pass any given point, oil begins to seep from the pockets onto the plateaus by capillary action, ready to lubricate the rings as they again pass.

### Cylinder Life Increased Five Times

The plated porous chromium surface has been demonstrated to markedly increase resistance to wear in internal combustion engines. Moreland[4] has presented a report in which he states that New York City bus engines so treated are good for at least 60,000 miles of operation against 20,000 to 25,000 miles for untreated engines. The six engines under discussion are standard 6-cylinder, 450 cu. in. displacement units manufactured by General Motors, trued-up to 0.012—0.014 in. oversize because of excessive wear and brought back to original diameter with porous chromium.

This report states in part:

"To strike an average from combined results, these engines with chromium processed cylinders wear out of round at the top, on the pressure side, to the extent of slightly less than 0.0012 in. at 12,500 miles. At 20,000 miles this condition increases to 0.0018 in. and is slightly under 0.0021 in. at 25,000 miles. This latter is the range within which cast iron bores have reached an out of round wear of 0.012 to 0.015 in. and require resizing.

"At 30,000 traffic miles, the chromium cylinders show a maximum average of 0.0025 in. wear and something less than 0.0030 in. at 35,000 miles. The figure increases to 0.0034 in. at 40,000 miles and becomes 0.0039 in. at 45,000.

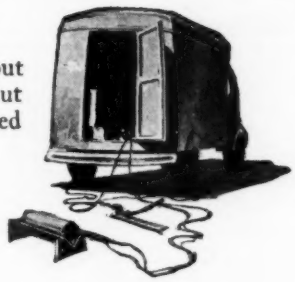
"Actual service figures on conditions that obtain from 45,000 to 60,000 miles, or above, are not available. Since none of the engines now within the range of 60,000 to 70,000 miles, within which a general overhaul normally is required, have been brought into the shop for dismantling, it is evident that the rate of wear has not increased appreciably even on cylinders showing a maximum out of round condition.

"We have made no note of an appreciable difference in oil or fuel consumption attributable to these specially processed cylinders. The fleet is supplied with SAE 40 paraffin base lubricant. Average consumption of the lubricant is 7.5 quarts per 1000 miles."

Van der Horst[5] has given graphical comparison of wear between chrome hardened liners and cylinder blocks with liners of hardened steel, alloyed cast iron (no further data) and nitrided cast iron. The superior performance of the chrome hardening in this test is shown in Fig. 2. Fig. 3 shows similar comparison for rings in plated and unplated standard cast iron cylinders; it was developed from

**PENETRON I —**

Measured thickness without drilling and calipering but weighed 400 lbs — required a trailer to carry it.



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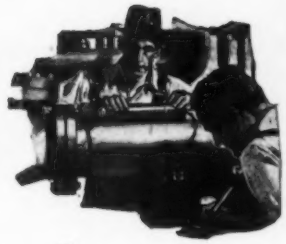
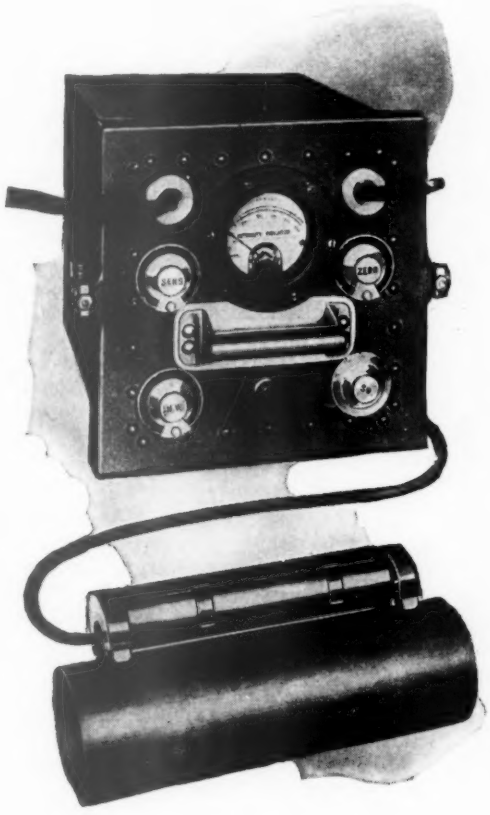
Achieved portability without loss of accuracy. Weight, only 40 lbs.



# Research in Action!



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Thanks to continuing research today's Penetron is *easily* portable yet even more sensitive. It weighs only 25 lbs.

## *How continuing Texaco Research developed a radically new idea and then made it better and better*

**THE PROBLEM:** The drilling and calipering of oil industry equipment to check corrosion is costly, time consuming and often unsatisfactory. Texaco Research sought a better method that would quickly and accurately measure the thickness of a pipe or vessel *working from one side only.*

**FIRST SOLUTION:** After careful consideration exhaustive experiments with radium were undertaken. This resulted in the original Penetron, an efficient instrument but so heavy it had to be carried in a trailer.

**SECOND SOLUTION:** Further research reduced the weight from 400 to 40 lbs. The instrument was now portable and equally efficient but still heavy.

**PRESENT SOLUTION:** An instrument of even greater accuracy weighing only 25 lbs.

Thanks to Texaco Research today's Penetron is easily portable, easier to use. In addition to measuring wall thickness it is used to determine both the density and levels of contained liquids from outside the equipment.

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data taken by the Institution of Automobile Engineers (British).

An article by Birdsall[6] cites a number of other service records, among which are the following:

"Application to piston rings has been attended by favorable results, according to T. C. Jarrett, chief metallurgist, Koppers Co., American Hammered Piston Ring Division, Baltimore. Several other aircraft piston ring manufacturers are also using the finish . . . .

"A cargo vessel has traveled 1.2 million miles without replacing its treated cylinders. . . . .

"Baldwin Locomotive Works reports processed liners last six to eight times as long as bare cast iron.

"Willett Co., Chicago, has run a tank truck-and-trailer engine at capacity loads for 110,000 miles with cylinder wear of only 0.002 in."

At the present time the Van der Horst Corp. is processing large numbers of Diesel engines for the U. S. Navy, the first submarine-type engines using Porus-Krome plated cylinders being those of the salvaged U. S. S. Squalus in 1939. Special problems of ring-feathering in the Navy "Wildcat" carrier-based aircraft were eliminated by plating the rings with porous chromium. The cylinders of other types of aircraft engines are being surfaced with channel-type Porus-Krome.

Army tank and aircraft engine cylinders, worn after severe use in combat, have been reclaimed through oversizing and plating with Porus-Krome; Navy Diesel engines have been similarly reconditioned and many trucks as well.

Costs of treating engine cylinders or piston rings can be most economically reduced during manufacturing. The cost of the carefully machined jigs and anodes, plus the developmental engineering required to determine the optimum surface for the specific application at hand, are necessarily high initially. Spread over a large number of units, however, this cost becomes a minor consideration and the major cost develops as the expense in handling the items to be plated. All of this can and is being done on a large mass-production basis.


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# Russians Recover 90-95% of Sulfuric Acid From Sludge, Obtain Valuable Byproducts

IMPORTANT results from laboratory and plant-scale research on utilization of sulfuric acid sludge as being published in Russian scientific journals and translated in the UOP Survey of Foreign Petroleum Literature, edited by J. G. Tolpin, include:

1. Recovery of the acid from the sludge for regeneration and re-use. In some cases the amount of the acid reclaimed may reach 90-95%. Its concentration is raised by various means to 80% or higher.

2. Recovery of valuable byproducts, including naphthenic acids, sulfonaphthenic acids, sulfur dioxide and fuel oil, from the organic portion of the sludge. Naphthenic acids present in kerosene are retained in the sludge from which they can be reclaimed in yields from 2 to 7% of the organic portion of the sludge.

### Reduction of Loss Important

To reduce the loss of sulfuric acid is important the world over and especially so in Russia, where the growth of the oil refining industry has greatly increased acid consumption.

Recovery of naphthenic acids from the organic portion of the sludge is likewise of great importance, as they are in growing demand for the manufacture of detergents and insecticides.

From the tenor of the Russian reports, it appears that the research work, though still in the experimental stage is being directed toward the eventual establishment of an industry to produce drying oils, detergents, alcohols, demulsifying agents, electrical insulation material, and other byproducts from the organic portion of sulfuric acid sludge.

K. P. Likhushin reviewed the state of Russian laboratory and plant-scale research on utilization of acid sludge in a book published in 1939. Subsequent laboratory studies on this subject appeared in Russian journals in 1941 and 1942.

According to Likhushin, acid sludge from oil refining may contain up to 70% of unreacted sulfuric acid. Sludge formed by treating with fuming acid contains three to four times as much free acid as sludge formed by sulfur trioxide.

His book states that acid and organic matter in the sludge can be separated by dilution with water or treatment with steam and hot water. The organic substances can also be extracted with solvents, such as xylene, dichloroethane, or the residue from rerunning pressure distillates.

Direct use of acid sludge as a refining agent or as fuel, and methods of raising the concentration of the reclaimed acid, are also discussed. It is stated that up to 81% of acid of 73% concentration may be recovered from distillate oil sludge by heating up to 120° C.

Electrical heating consumes 44 kw. hours per ton of sludge, gives purer acid and reduces corrosion of equipment.

Pretreatment of residual oils with sulfonic acids before treatment with sulfuric acid makes possible subsequent recovery from the sludge of up to 90% of sulfuric acid in up to 30% strength and leaves a satisfactory fuel almost acid-free.

Heating reclaimed concentrated sludge acid with 5% technical nitric acid makes it suitable for re-use in oil refining, giving a sludge from which the acid again can be recovered.

Heating acid sludge or its aqueous extract at 210° to 300° C., in the presence of charcoal or coke, gives a mixture of gases containing up to 78% sulfur dioxide.

### Electrolytic Method

An electrolytic method was described in 1942 by which acid of satisfactory color is obtained from a sludge and is then concentrated by evaporation to 92% strength. This method has been patented under the Soviet patent law.

Acid treating of benzene and toluene produced by pyrolysis of oil gives a sludge which can be used to refine xylene, or for preliminary treatment of benzene or toluene, which is followed by treatment with fresh acid.

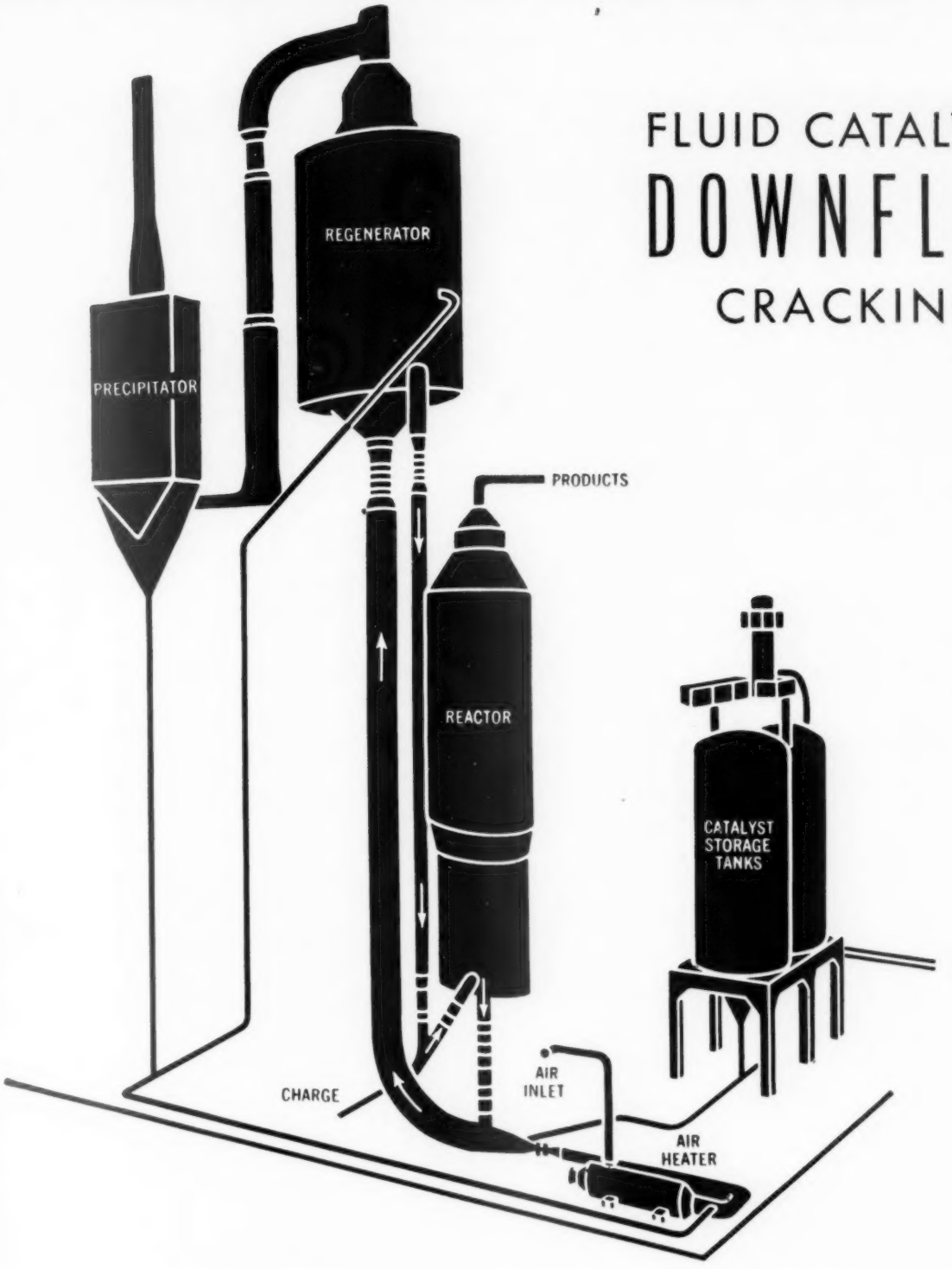
This preliminary treatment saves 20 to 25% of sulfuric acid. In one Soviet refinery, treating xylene with sludge acid was made a standard practice in about 1932.


**Reprints**

Reprints of any articles appearing in the NPN TECHNICAL SECTION ordinarily are made only on order. Because present conditions prevent our holding the type after an issue is published, inquiries for quantity reprints should be forwarded promptly after receipt of the issue, by telegram if possible. Reprints ordered after the type has been broken down have to carry the additional cost of resetting the article.

Should you desire an article reprinted for you, **please order the reprints promptly.**

# FLUID CATALYTIC DOWNFLOW CRACKING



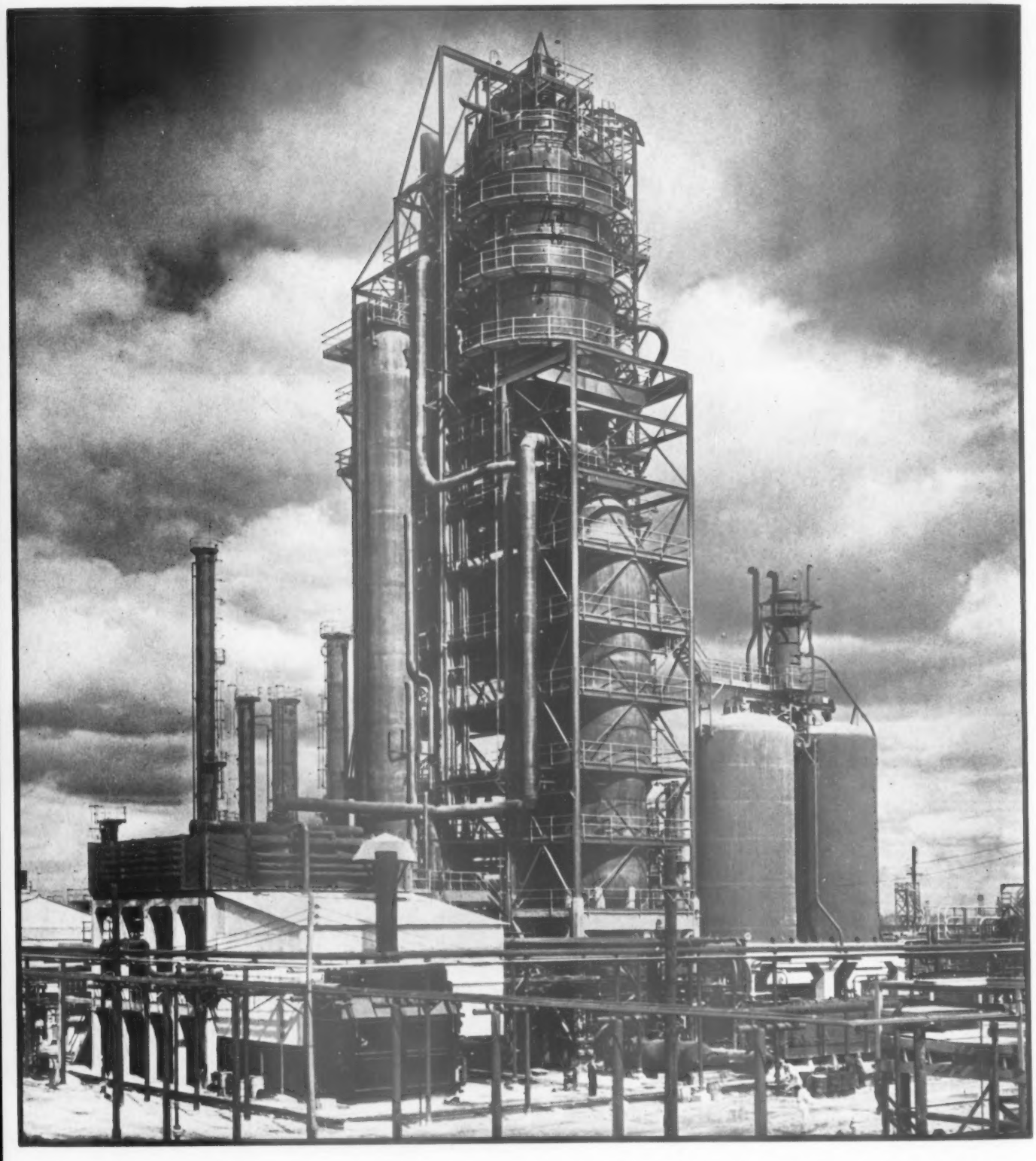

Cost per gallon of Gasoline (of comparable Octane) is the only true measure of the overall efficiency of a cracking process.

Octanes (as high as 99.8 Research)—Charges (as heavy as 90% at 1065°F.)—"Onstream" (as long as 6 months) are operating accomplishments which classify FLUID CATALYTIC "DOWNFLOW" CRACKING as the most economic method for producing HIGH OCTANE MOTOR GASOLINE.

Reprints of the technical description and advantages of this improved catalyst flow, titled "IMPROVED FLUID PROCESS FOR CATALYTIC CRACKING" by E.V. Murphree et al (presented at the November 1944 meeting of the A.I.Ch.E.) are available on request. Address Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.

**FOSTER WHEELER**

# *"Octane Independence"*



Octane competition is no problem to a refiner using FLUID CATALYTIC CRACKING. Performance records covering a wide variety of operating procedure represent substantial proof, that a "FLUID" unit can place a refiner in that desirable manufacturing position of being able to meet any competitive Octane situation.

## FOSTER WHEELER CORPORATION

**165 Broadway, New York 6, N. Y.**

*Third Instalment*

# P.A.W. Refinery Inspection Manual

*Part 1—Process Equipment (Continued)*

**This section of the PAW "Wartime Recommendations for Refinery Inspections" discusses the minimum allowable metal thicknesses for petroleum processing equipment, including pressure vessels, valves and fittings, pipe, shell and tube heat transfer equipment, fired tubes, tube header boxes, and pumps and compressors. It covers the factors affecting these limits, and presents working charts for determining them under various operating conditions of temperature and pressure.**

**The manual was prepared by PAW with the cooperation of engineers in charge of inspection work for several of the large refining companies.**

**The manual is in four parts, covering Refinery Process Equipment, Electrical Equipment, Instruments, and Fire Protection Equipment. As it is being published in the NPN TECHNICAL SECTION, this instalment is the third of Part 1, Process Equipment. The first instalment (July 4, 1945, pg. R-500) covered the general scope and organization of an inspection department for refinery process equipment; the second (Aug. 1, 1945, pg. R-582) covered methods of inspection and their application. Part 1 will be concluded in the fourth instalment (in the Oct. 3 issue), and will be followed by Parts 2, 3 and 4 in succeeding issues.**

## *SECTION 4—Determination of Limits*

### 141. General

**141.01—Limitations.** It should be recognized that the limiting thickness of numerous items of refinery equipment cannot be computed with a satisfactory degree of accuracy, and specific rules for retirement of such equipment may not result in safe or economical retirement practices. In many such cases an arbitrary minimum limit must be set, based on practical operating experience and inspection and engineering judgment. In other cases it may be necessary to rely on hydrostatic pressure or "proof" tests for equipment such as pumps, etc., which cannot be readily calculated.

**141.02—General Considerations Affecting Limits.** In arriving at the allowable limits for any piece of equipment, the following factors should be considered:

**141.02(a)—Contents.** The character of the contents of the equipment and the hazards created in case of a failure are important factors. The greater the potential hazards, the more care must be taken to prevent failure or leaks, and the greater the relative factor of safety that must be provided.

**141.02(b) — Temperatures and Pressures.** The temperature adversely affects the strength of materials of construction, due to creep, oxidation, etc. The pressure is the primary factor in determining the required thickness to prevent failure and is also a measure of the contained energy.

**141.02(c)—External Loadings.** The external loadings may be additive to those caused by pressure loading or temperature stress and may thus affect the required metal thickness.

**141.02(d)—Type of Construction.** The type of construction determines the magnitude of the working stresses than can be permitted.

**141.02(e)—Materials of Construction.** Materials of construction also govern the permissible working stresses. Certain materials have very definite limits of safe use because of their lack of resistance to certain corrosive agents or ranges of temperatures.

**141.03—Methods of Determining Limits.** The following sections discuss methods of determining retirement limits for various classes of refining equipment. Where practicable, tables, curves, and nomographs are included showing the suggested minimum limits for the various operating pressures and temperatures. It is strongly recommended that a form be maintained for recording established design limitations. Examples of such forms filled out for typical refinery equipment are shown in Figs. 9 and 10.

### 142. Pressure Vessels

**142.01 — Determination of Limits Based on Applicable Codes.** The recommended applications of the various codes and regulations for determining the safe limits (i.e., allowable working pressures, safety valve settings, minimum thicknesses, etc.) of pressure vessels in refineries are given below:

**142.01(a) — Unfired Process Vessels.** Where process vessels* are constructed in accordance with the API - ASME "Code for Unfired Pressure Vessels" for petroleum liquids and gases, or the ASME "Unfired Pressure Vessel Code"

*Process vessels include any vessels handling petroleum liquids or gases as well as vessels containing any other commodity used in the refining or associated processes.

### *REPRINTS of the REFINERY INSPECTION MANUAL*

Since, in many instances, different inspectors are responsible for the four groups of equipment which are covered by the four Parts of the PAW Refinery Inspection Manual, reprints will be made of each Part as a unit.

These reprints, each Part complete, will be available on or near the following dates:

Part 1, Processing Equipment, October 15, 1945
Part 2, Electrical Equipment, November 15, 1945
Part 3, Instruments, December 15, 1945
Part 4, Fire Protection Equipment, January 15, 1946

The reprint of Part 1, approximately 32 pages, will be bound in stiff paper covers, stapled; Parts 2, 3 and 4 will have from 8 to 12 pages and will be bound in self-covers, stapled.

Since the Manual is an on-the-job working tool, one copy of each of these four reprints will be supplied FREE to NPN subscribers, upon request. This will provide a working copy of the Manual for NPN subscribers without mutilation of file copies of the TECHNICAL SECTION.

Additional copies of the reprints will be supplied at the following prices:

Part 1—75 cents each  Part 2—20 cents each
Part 3—20 cents each  Part 4—20 cents each

Although reprints will not be ready until sometime later as indicated above, orders may be placed now with shipment and billing to be made as soon as the reprint of each complete Part becomes available. Orders should specify the quantity of reprints of each Part, and be placed with NATIONAL PETROLEUM NEWS, 1213 West Third Street, Cleveland 13.

## UNFIRED PRESSURE VESSEL DATA SHEET

REFINERY

NAME OF VESSEL _____ EQUIPMENT NO. _____
DATE PLACED IN SERVICE _____ LOCATION _____
MEDIUM HANDLED _____ INITIAL TEST PRESSURE _____
ORDER NO. _____ MANUFACTURED BY _____
SIZE _____ TYPE OF CONSTRUCTION (RIVETED / WELDED) _____
G. O. CORP. DWG. NO. _____ MANUFACTURER'S DWG. NO. _____
NO. & SIZE OF SAFETY VALVES _____
LINING _____
TELL-TALE HOLES DRILLED _____

| POINT | ORIGINAL THICKNESS | THICKNESS WHEN WASHERS INSTALLED | OPERATING PRESSURE LBS. PER SQ. INCH | OPERATING TEMPERATURE DEGREES F. | SAFETY VALVE SET AT LBS. PER SQ. INCH |
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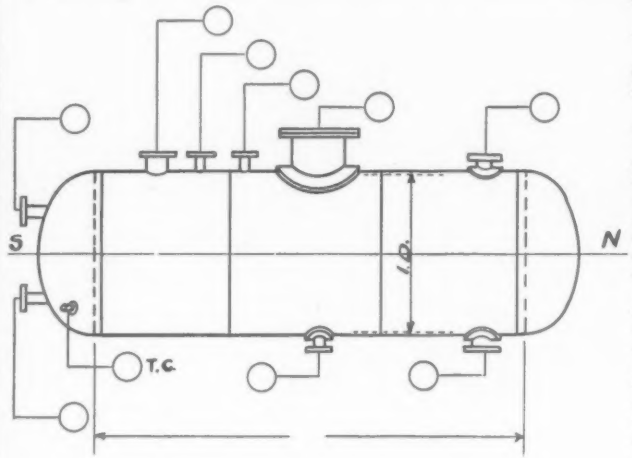


| | | |
|---|---|---|
| HEADS | ELLIPTIC | OUTS. DIMS. |
| | MAJOR AXIS | INS. |
| | MINOR AXIS | INS. |
| | MAJOR AXIS | INS. |
| | MINOR AXIS | INS. |
| HEADS | DISHED. | OUTS. DIMS. |
| | CROWN RAD. | INS. |
| | KNUCKLE R. | INS. |
| | CROWN RAD. | INS. |
| | KNUCKLE R. | INS. |
| SHELL | OUTSIDE DIAMETER | |
| | | INS. |
| | | INS. |
| CONE | COS θ = | |
| AXIAL JOINT EFFICIENCY | | % |

NOZZLES & MANHEADS

| SIZE | JOINT EFF. | MIN. ALLOW. WALL THICKNESS | | |
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| DATE | | | | |

MADE BY _____ DATE _____
REV. _____ _____
REV. _____ _____
REV. _____ _____
PITTSBURGH OFFICE REFERENCES

JOINT EFFICIENCIES FOR:

| | |
|---|---|
| LAP WELDED CARB. STEEL PIPE | 80% |
| ELECTR. FUSION WELDED PIPE | 85% |
| SEAMLESS FORGED STEEL NOZZLE | 100% |

FIG. 9—Typical Data Sheet for Recording Established Design Limitations for an Unfired Pressure Vessel

## CORROSION RECORD FOR PRESSURE VESSELS

NOTE: SEE CORROSION GAGING INSTRUCTIONS AND DATA FOR PRESSURE VESSELS.

| POINT "A" DATE OF GAGE READING | OPER'T'G TEMP. °F | OPER'T'G PRESS. LBS./SQ. IN. | HORIZONTAL RIGHT 1 | HORIZONTAL RIGHT 2 | HORIZONTAL LEFT 1 | HORIZONTAL LEFT 2 | PERPENDICULAR UP 1 | PERPENDICULAR UP 2 | PERPENDICULAR DOWN 1 | PERPENDICULAR DOWN 2 | MAX. CORROSION INCHES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGINAL | | | | | | | | | | | |
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| POINT "B" DATE OF GAGE READING | OPER'T'G TEMP. °F | OPER'T'G PRESS. LBS./SQ. IN. | HORIZONTAL RIGHT 1 | HORIZONTAL RIGHT 2 | HORIZONTAL LEFT 1 | HORIZONTAL LEFT 2 | PERPENDICULAR UP 1 | PERPENDICULAR UP 2 | PERPENDICULAR DOWN 1 | PERPENDICULAR DOWN 2 | MAX. CORROSION INCHES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGINAL | | | | | | | | | | | |
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| POINT "C" DATE OF GAGE READING | OPER'T'G TEMP. °F | OPER'T'G PRESS. LBS./SQ. IN. | HORIZONTAL RIGHT 1 | HORIZONTAL RIGHT 2 | HORIZONTAL LEFT 1 | HORIZONTAL LEFT 2 | PERPENDICULAR UP 1 | PERPENDICULAR UP 2 | PERPENDICULAR DOWN 1 | PERPENDICULAR DOWN 2 | MAX. CORROSION INCHES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGINAL | | | | | | | | | | | |
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| POINT "D" DATE OF GAGE READING | OPER'T'G TEMP. °F | OPER'T'G PRESS. LBS./SQ. IN. | HORIZONTAL RIGHT 1 | HORIZONTAL RIGHT 2 | HORIZONTAL LEFT 1 | HORIZONTAL LEFT 2 | PERPENDICULAR UP 1 | PERPENDICULAR UP 2 | PERPENDICULAR DOWN 1 | PERPENDICULAR DOWN 2 | MAX. CORROSION INCHES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGINAL | | | | | | | | | | | |
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| POINT "E" DATE OF GAGE READING | OPER'T'G TEMP. °F | OPER'T'G PRESS. LBS./SQ. IN. | HORIZONTAL RIGHT 1 | HORIZONTAL RIGHT 2 | HORIZONTAL LEFT 1 | HORIZONTAL LEFT 2 | PERPENDICULAR UP 1 | PERPENDICULAR UP 2 | PERPENDICULAR DOWN 1 | PERPENDICULAR DOWN 2 | MAX. CORROSION INCHES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGINAL | | | | | | | | | | | |
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CORROSION RECORD FOR PRESSURE VESSELS

VESSEL _____ STILL No. _____ EQUIPMENT No. _____

NOTE: CALIBRATIONS ARE TO BE ENTERED IN 64THS OF AN INCH.

FIG. 10—Typical Data Sheet for Recording Corrosion Data for Pressure Vessels

**AEROCAT**—synthetic fluid cracking catalyst—cracks more molecules into high-octane motor fuel on a per barrel of feed basis than was thought possible in pre-AEROCAT days. It insures more efficient—more economical operation for your plant and a higher quality motor fuel.

While you are supplying war power today—and when you are producing automobile and airplane power tomorrow—AEROCAT is the means to maximum quantity and quality output.

Supplies of AEROCAT, made in Grades F and G, and manufactured according to specifications developed by Universal Oil Products Company, will be delivered to you promptly from Cyanamid's plant at Fort Worth, Texas. Our technical field service representatives will also be glad to work with you to give first-hand advice and help.

*When Performance Counts... Call on Cyanamid*

**MORE MOLECULES INTO MORE HIGH-OCTANE FUEL...**

**WITH AEROCAT***

American CYANAMID & Chemical Corporation

(A Unit of American Cyanamid Company)

30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

*Trade-mark of American Cyanamid & Chemical Corporation denoting cracking catalyst of its manufacture.

or Federal or State government regulations, the limits should be determined in accordance with the code under which the vessels are operating.

**142.01(b)—Waste Heat Steam Boilers.** Where vessels are used as unfired steam boilers (such as waste heat steam generators) the limits should be determined according to the ASME "Unfired Pressure Vessel Code" and the ASME "Power Boiler Code" (See paragraph U-2).

**142.01(c)—I.C.C. Containers.** Vessels constructed as I.C.C. shipping containers and used in such service must be maintained and retired in accordance with the I.C.C. regulations.

**142.01(d)—Fired Process Vessels.** In the case of fired process vessels (shell stills, etc.) neither the API-ASME Unfired Vessel code nor the ASME Boiler or Unfired Vessel codes is strictly applicable; however, any of these references can be used as a guide to good practice in determining ratings and limiting thicknesses for such equipment.

**142.01(e)—Steam Boilers.** Steam boilers, with no exceptions, should be rated and their limits fixed in accordance with the ASME "Power Boiler Code" unless legally required to be maintained to some other code.

**142.01(f) — Power Plant Auxiliaries.** Steam power plant auxiliary equipment such as steam separator drums, feedwater treating vessels, etc., and air pressure tanks should have their limits determined in accordance with the ASME "Unfired Pressure Vessel Code," unless legally required to be maintained to some other code.

**142.01(g)—Spheres and Spheroids.** In the case of spheres and spheroids for storage of natural gasolines and other high vapor pressure products, the limiting thicknesses should be determined using the allowable working stresses and joint efficiencies given in the API-ASME code.

**142.01(h)—Old Equipment.** In the case of vessels which were not designed to any present code and are still in the service for which they were originally constructed, the limits should be determined according to the original design basis, as long as there is no reason now to consider this basis unsafe. Where the original design basis is not known, or where vessels have been changed from the service for which they were originally built, the allowable working pressure and retirement limits should be determined according to the API-ASME "Code for Unfired Pressure Vessels," including Section I and the Apppendix to Section I, of that code. These sections specifically cover the application of the code to existing vessels.

**142.01(i)—General.** Where the service or construction of a vessel is entirely beyond the scope of these codes the safe limits must be determined for the particular case by a competent engineer.

Note: It should always be borne in mind that the determination of minimum limits according to these codes often involves the consideration of structural strength and of other loadings, in addition to the pressure loading. Hence care should be taken in calculating limits that all such factors are considered.

**142.02—Typical Charts for Determination of Limits.** Some of the limits defined by these codes are used so frequently in inspection practice that they can be profitably set up in chart form. Again limits requiring extensive calculations can be recorded to save time in future determinations. Figs. 11, 12 and 13 are typical examples of charts and forms which can be prepared to save time and calculations.

### 143. Valves and Fittings

**143.01—General.** Owing to the complex shape of valves and fittings the magnitude of stress at various points due solely to internal pressure is practically indeterminate. Stresses are also introduced by line strains due to various causes such as expansion or contraction from temperature changes, etc. In valves, additional stresses may also be set up when a valve is closed, due to the seating pressure necessary to make a valve tight. To allow for these and other indeterminate stresses, the ASA multiply the thickness required for pressure by the factor 1.5.

**143.02—Limiting Thickness.**

**143.02(a)—Cast Iron.** The determination of a retirement thickness for cast iron is less frequently a problem than it is for steel fittings. The retirement thickness for cast iron fittings may be taken as one-half of the minimum wall thickness given in ASA tables B-16-a

(*Continued on page R-746*)

**UNFIRED PRESSURE VESSEL INSPECTION REPORT**

_____ REFINERY

VESSEL _____ EQUIPMENT NO. _____

LOCATION _____ DATE OF INSPECTION _____

WAS INTERIOR WALL THOROUGHLY CLEANED FOR INSPECTION? _____

(A) SHELLS—GENERAL CONDITION _____
WERE ANY CRACKS NOTED? _____
WAS ANY UNUSUAL OR LOCAL CORROSION NOTED? _____

(B) HEADS —GENERAL CONDITION _____
WERE ANY CRACKS NOTED? _____ ANY DISTORTION? _____
WERE KNUCKLES INSPECTED? _____

(C) JOINTS—CONDITION OF WELDING _____
WERE ANY CRACKS NOTED? _____
CONDITION OF RIVETS _____
OTHER FINDINGS _____

(D) NOZZLES & OPENINGS—(NOTE WALL THICKNESS IN SPACE PROVIDED)
CONDITION OF JOININGS _____
CONDITION OF LINERS _____

(E) LINING—GENERAL CONDITION _____
WAS ENTIRE LINING EXAMINED? _____
REMARKS _____

(F) WAS HYDROSTATIC TEST MADE? _____ TEST PRESSURE _____
RESULTS _____

(G) WERE SAFETY VALVES EXAMINED? _____
DATE OF LAST TEST? _____ CONDITION OF DISCHARGE LINES _____

(H) INSULATION —GENERAL CONDITION _____

(I) SUPPORTS —GENERAL CONDITION _____

(J) FIREPROOFING—GENERAL CONDITION _____

NOTE: USE BACK OF THIS SHEET FOR SKETCHING LOCATION OF DEFECTS, AND MAKING MORE DETAILED REPORT ON THE ABOVE ITEMS, AND ANY OTHER ITEMS.

WALL THICKNESS OF NOZZLES (MIN. CALIBRATION)

| NO. | THICKNESS | NO. | THICKNESS | NO. | THICKNESS | NO. | THICKNESS | NO. | THICKNESS | NO. | THICKNESS |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| VESSEL THICKNESS AT CRITICAL POINTS | DESCRIPTION OF LOCATION | MAX. WORK. TEMP. | ALLOW. STRESS | JOINT EFF. | MAX. WORK. PRESS. |
|---|---|---|---|---|---|
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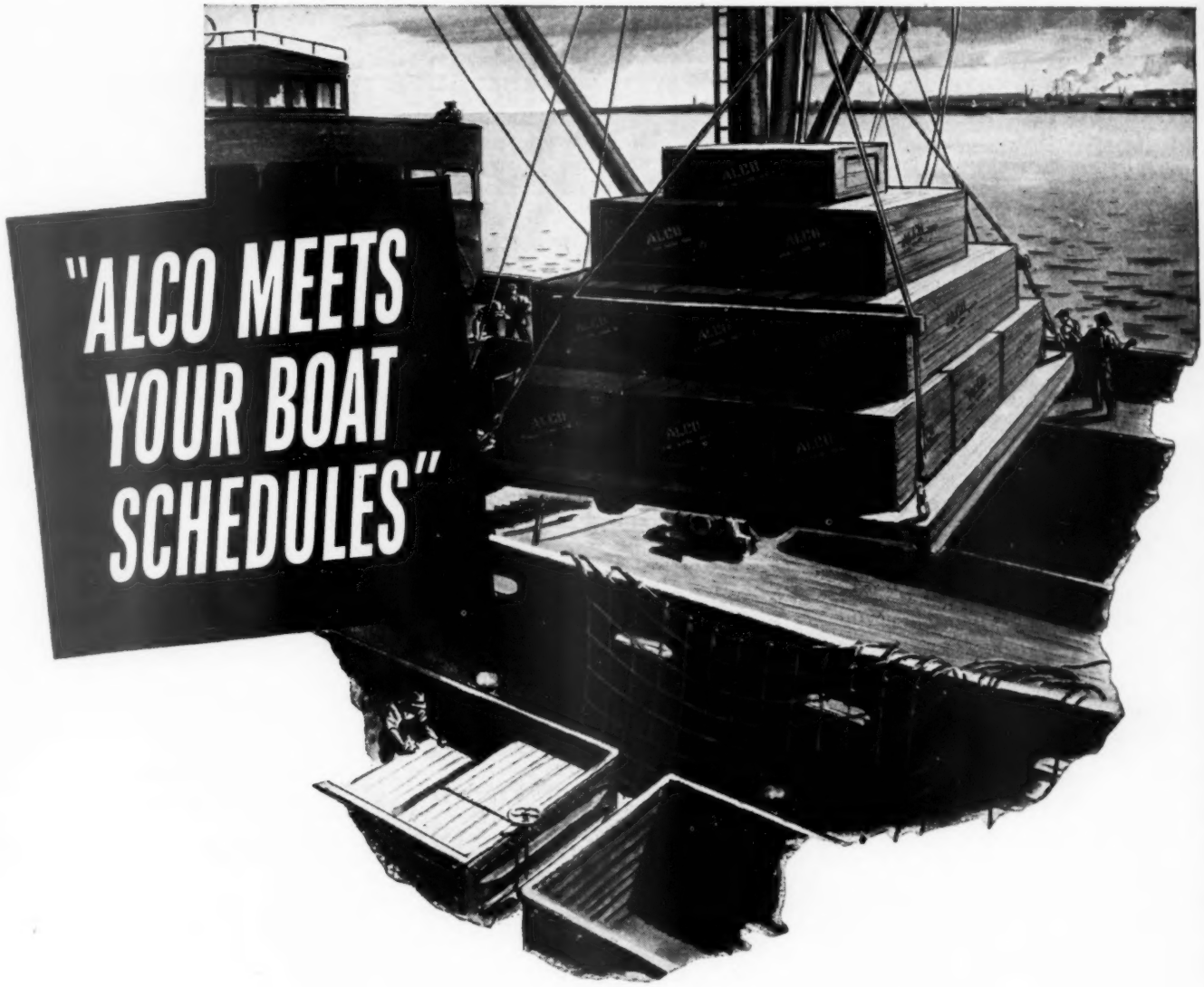
TOTAL NO. HOURS IN SERVICE _____ NEXT INSPECTION _____ HOURS.

INSPECTOR _____ FILE NO. _____

**Fig. 11—Typical form for recording results of an inspection on an unfired pressure vessel**




# Alco Prefabricated-Pipe Service

## Expert Pipe Benders for All Export or Home Needs

To handle a pipe-prefabricating job right—quality, price and delivery—is a tough job, especially for export.

Bending and heat-treating are no easy arts. But for export—there is the added trouble of boxing. It takes a great deal of experience to box prefabricated pipe involving complicated bends. ALCO does it in a way that saves ship space and gets you the lowest possible shipping charges.

Large, completely equipped ALCO shops produce prefabricated piping to close tolerances in all alloys. Its facilities include stress-relieving and annealing furnaces, big bending tables and machines, modern apparatus for X-ray inspection, its own special boxing department.

ALCO's thorough understanding of proper marking ensures quick identification essential to lowest-cost installation.

ALCO knows every custom, rule and regulation affecting prefabricated-pipe shipments for export—meets your boat schedules—smooths the progress of your prefabricated-pipe job *all the way.*

## Also available—ALCO Electric-welded Steel Pipe

In addition to prefabricated piping, ALCO makes electric-welded steel pipe from 20-inch to 120-inch diameters in lengths up to 40 feet.

**American Locomotive**

**ALCO PRODUCTS DIVISION**

*30 Church Street, New York 8, N. Y.*
*Dunkirk, N. Y.*



R-693

# Patent Trends in Petroleum Refining

*By Peter J. Gaylor*

**To keep its readers informed of developments in new and improved refining processes, NPN's Technical Section has arranged with a leading authority to screen current patents and review those of importance to petroleum refiners in a regular feature, "Patent Trends in Petroleum Refining." U. S. patents will be reviewed as issued and foreign patents as soon as data becomes available.**

**Author of this regular feature of NPN's Technical Section is Peter J. Gaylor, patent attorney and editor of the *Technical Survey*, Newark, N. J.**

## Pour Inhibitors and Thickeners

Only a few pour inhibitor patents have been issued recently. So, when a potent product is disclosed, it is worthy of discussion. In U. S. 2,370,943, duPont describes the production of pour inhibitors which have a high stability against breakdown under oxidizing conditions.

In one example, octadecylamine is reacted with maleic anhydride, and the resulting product is mixed with styrene and heated in presence of benzoyl peroxide. The gummy resinous product, in 0.2% concentration, reduced the pour point of SAE 30 paraffin base oil from 30° F. to 0° F.

The product may be made by first reacting styrene (or indene) with maleic anhydride and then with the long chain amine. In one case a reduction of pour from 30° F. to —5° F. was obtained with 0.3%, while 2% raised the V. I. from 92.5 to 95.

The effectiveness of these compounds in reducing high temperature deposits is exhibited by the following data:

| | Mg Dep./ 30 cc. Oil |
|---|---|
| Oil alone | 231.5 |
| Oil with 0.5% styrene-*n*-octadecyl-maleimide polymer | 173.6 |
| % reduction | 25 |

In the past, duPont had covered an oil soluble polymer of an acrylic acid-amino alcohol product[1] as a V. I. improver. Polyesters are similar compounds, and they have been disclosed as V. I. improvers[2] with some pour inhibiting properties. Pour inhibition appears to be mainly a solubility phenomenon. In the case of the polyesters, solubility is controlled by the percentage of oxygen present. Here, nitrogen has an effect similar to oxygen in making the product less soluble in oil at the wax separation temperature.

**References:**

(1) U.S. 2,104,796 (duPont).
(2) U.S. 2,152,683 (Shell)
U.S. 2,123,641 (S.O.D.).

## Sulfur Containing Polymers

Outside of the well-known Thiokol synthetic rubbers, there are very few other sulfur-containing polymers worthy of mention. An interesting product has been covered recently by some duPont patents (U. S. 2,378,535-6) which employ ethylene sulfide, acetic acid, and pyridine as raw materials, all of which are obtainable from petroleum. These three ingredients, when reacted, give an 84% yield of 2-acetoxyethyl thiolacetate ($CH_3 — CO — S — CH_2 — CH_2 — O — CO — CH_3$) which boils at 107-8° C./17 mm. Pyrolysis of this substance gives a 43% yield of vinyl thiolacetate which boils at 121° C. and has a specific gravity of 1.0136.

When pure vinyl thioacetate is polymerized with catalysts, a colorless hard solid is obtained which has very little odor of the monomer. It can be copolymerized with styrene, vinyl chloride, vinylidine compounds, etc. to give interesting products. For example, interpolymers with methacrylic acid are useful as tanning agents for leather.

## Catalytic Oxidation Of Hydrocarbons

Work done in the past on hydrocarbon oxidation covers reams of multitudinous references. In spite of this, very little commercial activity has resulted, particularly in the aliphatic hydrocarbon field. Most of the drawbacks were the low yields per pass of useful products and the production of numerous oxidation derivatives requiring an expensive installation for recovery of relatively pure compounds.

In recent years, Shell has been obtaining patents on direct oxidation of hydrocarbons, using hydrogen bromide as catalyst. In its U. S. 2,380,675, it employs aliphatic hydrocarbons having at least three carbon atoms to the molecule. For example, a mixture of propane, oxygen and HBr in the ratio of 2:2:1 was reacted at 188° C. for 3 minutes, and the reaction product was found to contain 76 mol-% *acetone* and 11.2% *propionic acid*, calculated on the propane used.

In another example, a 2:2:1 volumetric mixture of *n*-butane, oxygen and HBr when reacted at 183° C. for 3 minutes, gave a yield of 52% *methyl ethyl ketone* and *diacetyl* (on the consumed butane). Similar oxidations of cyclopentane, cyclohexane and ethyl benzene have been carried out with high yields of ketonic products.

It has been found that condensation products are minimized when the reaction mixture is immediately scrubbed with a solution of sodium carbonate or calcium carbonate suspension, the method also serving as an excellent means for recovering the HBr as the bromide.

## Selected Patents of the Month

Brit. Appl. 8064/43 (Houdry)—Catalysis.

Brit. Appl. 966/45 (U.O.P.)—Spherical particles and their application.

Brit. Appl. 16,598 & 22,585/44 (Rohm & Haas)—Gel-forming hydrous silicates.

Brit. 570,467 (Shell) — Dehydrogenation and catalyst.

Brit. 570,157 (S.O.D.)—Catalysts.

Brit. 570,142 (U.O.P.)—Catalytic dehydrogenation.

Brit. 570,235 (Shell)—Beta olefins.

Brit. 570,210 (I.C.I.)—Gas escape reaction propelled devices.

U.S. 2,380,938 (S.O.Ohio)—Inhibiting cracking during aromatization by addition of butane and hydrogen.

U.S. 2,380,958 (Pure Oil)—Hydrocarbon conversion in presence of Br or I compound.

U.S. 2,380,989 (Nettel et al)—Combustion turbo engine drive.

U.S. 2,381,038 (duPont)—Continuous production of HCl and conj. diolefins by pyrolysis of chlorhydrocarbons.

U.S. 2,381,041 (Shell)—Alkylation.

U.S. 2,381,175 (U.O.P.)—Alkyl aromatic hydrocarbons.

U.S. 2,381,311 (Pasco) — Concentrating diolefins with cuprous pyridine.

U.S. 2,381,314 (Emery Ind.)—Grease.

U.S. 2,381,409 (Dow)—Recovery of isoprene.

U.S. 2,381,434 (S.O.Ohio)—Naphtha isomerization.

U.S. 2,381,470-3 & 709 (Sinclair) — Amines and nitriles by reacting olefins with ammonia using Co amination catalyst at 450-750° F. and 500 psi.

U.S. 2,381,481 (S.O.Ind.)—Converting hydrocarbon gases to liquids using alumina gel-complex fluoride catalyst.

U.S. 2,381,506 (S.O.Ind.)—Solvent containing oxidized isobutylene dimer.

U.S. 2,381,526 (Monsanto) — Vulcanizable butadiene polymers.

U.S. 2,381,691-2 (Phillips Petr.)—Butadiene by dehydrogenation of n-butane.

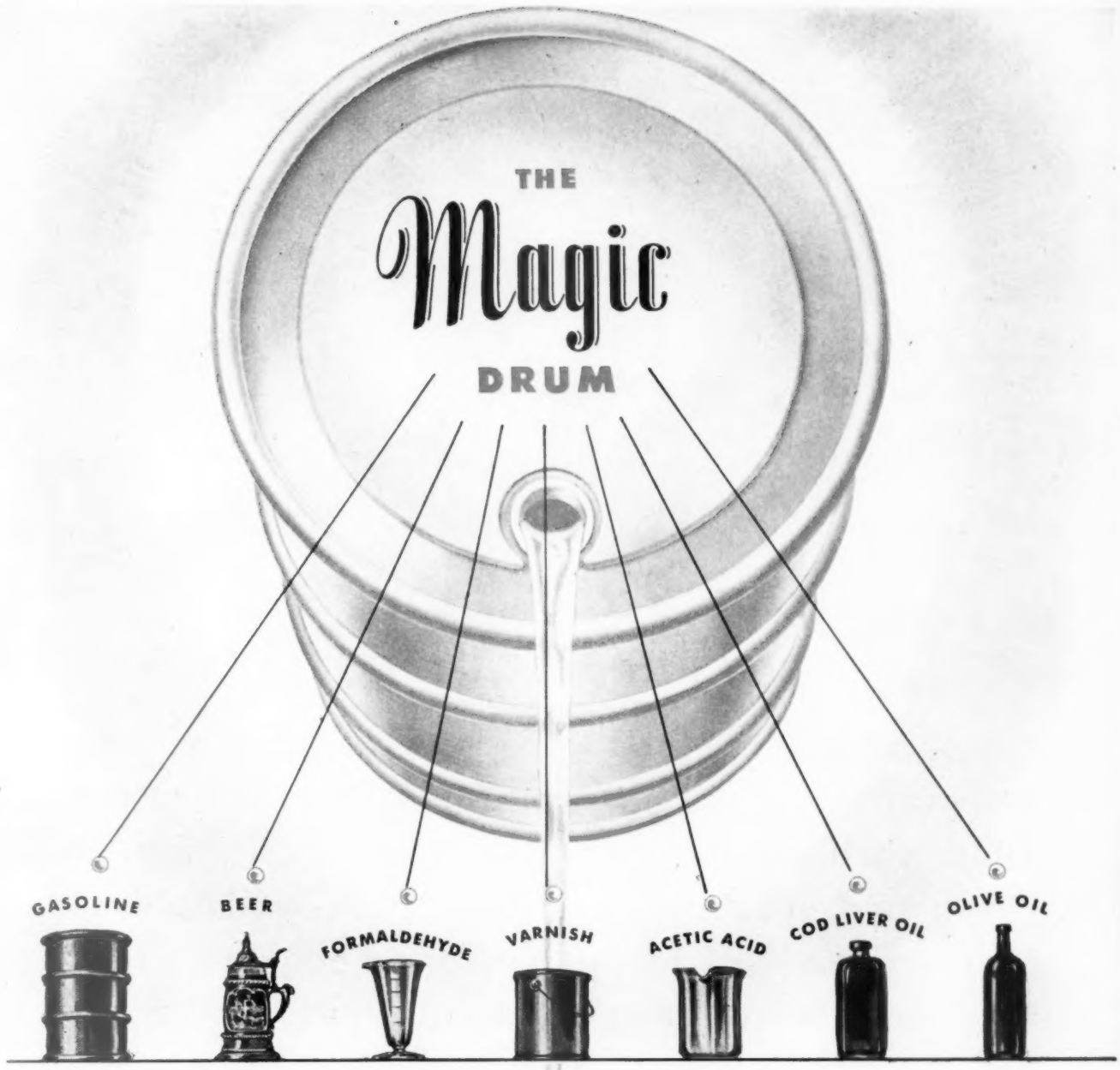
U.S. 2,381,708 (Union Oil) — Mahogany sulfonates.

U.S. 2,381,820 & 3 (U.O.P.)—Conversion catalyst.

U.S. 2,381,828 (U.O.P.)—Hydrocarbon conversion with butane, phosgene and halide.

Can. 429,190 (S.O.D.)—Ethylene oxide.

Can. 428,937 (Amer. Cyan.)—Infrared photometer.

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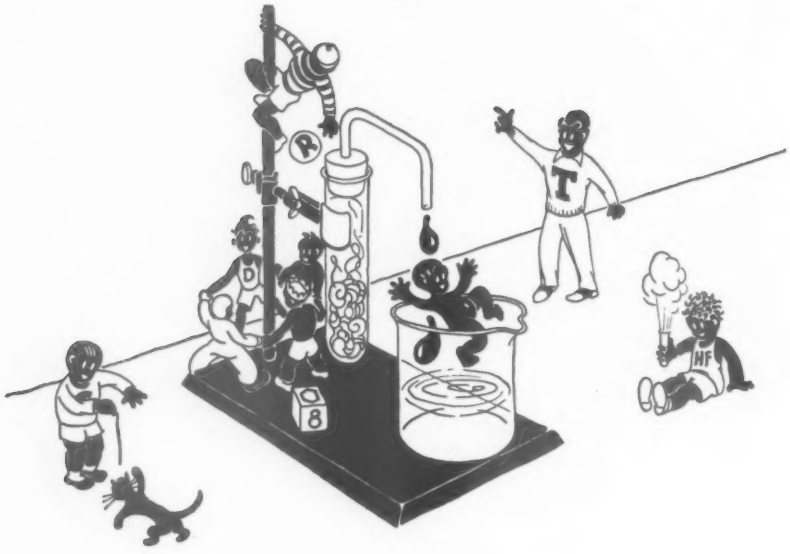


# *Test Tube Baby #9*
# *Isomerization*

Isomerization—changing normal paraffins into isoparaffins—was forthcoming as another of the UOP wonder babies. Butane and pentane, straight chain hydrocarbons, are now more valuable as they are changed by isomerization into isobutane and isopentane, branched chain hydrocarbons so necessary to produce aviation gasoline. At present there are thirteen UOP isomerization units in successful commercial operation.

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*CATALYTIC REFORMING*
*HYDROGENATION*
*ALKYLATION*
*ISOMERIZATION*

*THERMAL CRACKING*
*THERMAL REFORMING*
*HYDROFORMING*
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# The Formation of Carbon In Catalytic Cracking

*By Alexis Voorhies, Jr.*

**Studies in carbon formation in both fixed-bed and fluid catalyst cracking were made in equipment ranging from laboratory size to semi-plant scale. The same kind of equations relating conversion with feed rate and with catalyst residence time or catalyst to oil ratio can be derived for fluid catalyst cracking as for fixed-bed. Such equations have been used to construct graphical correlations that predict with satisfactory accuracy the conversions obtained at various feed rates and catalyst residence times or catalyst to oil ratios. These correlations have been found valuable in the analysis of data from commercial units.**

WHEN petroleum hydrocarbons undergo deep-seated reactions in the presence of solid catalysts, carbonaceous deposits usually accumulate on the catalyst and decrease its activity, so that periodic regeneration is necessary. A conspicuous exception is the case of high-pressure catalytic hydrogenation where the catalyst retains its activity for periods up to a year and longer without any regeneration[2]. Examples of regenerative processes are (*a*) catalytic cracking of gas oils and (*b*) catalytic reforming of naphthas. This paper presents a discussion of certain aspects of the formation of carbonaceous deposits in catalytic cracking.

The carbonaceous deposit that is an inevitable by-product of catalytic cracking is called "coke," and is generally determined as the weight per cent of carbon on feed or on catalyst. Some of the factors influencing carbon formation in catalytic cracking have been discussed[1, 3]. This catalytic coke is apparently, a hydrocarbon of relatively low hydrogen content, which may vary in accordance with feed stock or operating conditions. A formula of $(C_3H_4)_n$ has been reported[4]. The carbonaceous deposit also contains sulfur derived from the feed stock. However, the present discussion is concerned not with the hydrogen or sulfur content of catalytic coke but solely with the measured amount of carbon in the deposit.

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Although the extent of carbon formation in catalytic cracking depends on the type of catalyst, the feed stock, and the operating conditions, it has been found that there is an intrinsic uniformity in the way the carbon deposit on the catalyst increases with time. Certain generalized correlations of striking simplicity and considerable utility have resulted from a study of such data. As this paper will show, the usefulness of the relations developed extends beyond the field of carbon yields to include an equation defining the interdependence among feed stock conversion, feed rate, and length of period between catalyst regenerations. The generalizations and derived relations apply equally to fluid and fixed-bed cracking. The results reported here were obtained in equipment ranging from laboratory size to semiplant scale. The correlations derived have been applied to the commercial-scale units.

### General Considerations

The ordinary feed stock in catalytic cracking is a petroleum gas oil, the most volatile fractions of which have a higher boiling point than the back end of the gasoline produced. Thus, for aviation gasoline production, the initial boiling point of the feed stock will generally be above 300°F.; for motor gasoline, above 400°F. Although commercial catalytic cracking units today are employed for aviation rather than motor gasoline production, it is still convenient to refer to the feed stock conversion on the basis of production of motor gasoline. For simplicity, the products of catalytic cracking are often designated as follows:

| Feed Stock | % of Feed by: |
|---|---|
| Gas ($C_3$ and lighter) | Weight |
| Total $C_4$ | Volume |
| Aviation gasoline | Volume |
| Heavy naphtha | Volume |
| Cycle gas oil (400°F. initial b.p.) | Volume |
| Carbon (or coke) | Weight |

In this system the feed stock conversion is arbitrarily taken as 100 minus volume % cycle gas oil (400°F. i.b.p.). It is realized that this expression is not an exact measure of feed stock destruction. However, it furnishes a convenient means for correlating the yields of the various products. This definition of feed stock conversion is employed in this paper.

In catalytic cracking, either fluid or fixed-bed, the extent of conversion is determined by such factors as catalyst, feed stock, temperature, pressure, feed rate, and length of time between catalyst regenerations (here called "catalyst residence time"). In fixed-bed cracking the conversion measured is the summation of the instantaneous conversions throughout the process period, the instantaneous conversions decreasing with time on stream as the catalyst becomes fouled with coke. Fluid catalytic cracking differs from fixed-bed as follows:

1. Catalyst is currently regenerated in a separate vessel, so that feed stock and freshly regenerated catalyst are continuously brought together in the reactor.
2. As a result of the above, a uniform conversion is maintained, rather than a continuously decreasing conversion as in the process cycle of fixed-bed cracking.
3. The catalyst residence time in fluid cracking is generally much shorter than the time between regenerations in fixed-bed work.

In either fluid or fixed-bed cracking, conversion increases with increasing temperature, decreasing feed rate, and decreasing catalyst residence time. The effect of increasing pressure, at least up to about 50 pounds per square inch gage, is to increase conversion. However, pressure was not a variable in the data presented here because substantially atmospheric pressure was employed.

In fluid cracking the feed rate is generally expressed as weight of feed per hour per weight of catalyst held in the reactor or w/hr./w. Another term employed in fluid cracking is the catalyst-to-oil ratio, which is the ratio of the weight rates of flow of catalyst and oil. The catalyst residence time in the reactor is related to the w/hr./w and catalyst/oil ratio as follows:

$$W \cdot \theta/60 = 1/Z$$

or

$$W = 60/Z \cdot \theta$$

where

$W$ = w/hr./w,
$Z$ = catalyst/oil ratio, and
$\theta$ = catalyst residence time, min.

In fixed-bed cracking the feed rate is usually defined as volumes of feed per volume of catalyst per hour, or v/v/hr. The relation between w/hr./w and v/v/hr. is:

$$W = U \cdot D_o/D_c$$

where

$U$ = v/v/hr.,
$D_o$ = density of feed, and
$D_c$ = density of catalyst.

At a given temperature the depth of catalytic cracking, as measured by conversion, determines the quality and yields of the various products. Thus the yields of gas and carbon invariably increase with increasing conversion. At a given conversion level, the quality and yields of the various products depend on the temperature, but are virtually independent of relative feed rate and catalyst residence time. Thus whether a given conversion is obtained by a high feed rate and a short residence time or vice versa, the yields of carbon and other products are substantially unaffected. The relation between carbon on feed and conversion is especially important. This carbon yield refers to catalytic carbon produced in the reaction and does not include the so-

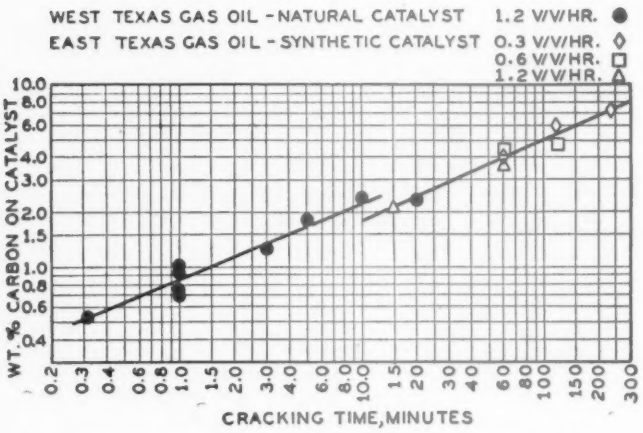

WEST TEXAS GAS OIL - NATURAL CATALYST 1.2 V/V/HR.
EAST TEXAS GAS OIL - SYNTHETIC CATALYST 0.3 V/V/HR.
0.6 V/V/HR.
1.2 V/V/HR.
WT. % CARBON ON CATALYST
CRACKING TIME, MINUTES

Fig. 1—Carbon formation vs. cracking time in fixed-bed catalytic cracking

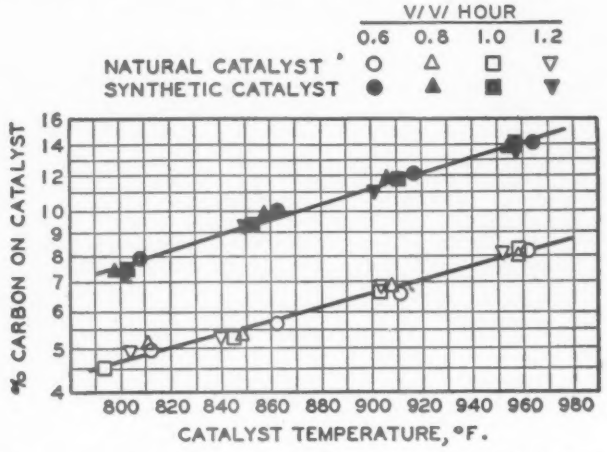



Fig. 2—Carbon formation vs. cracking temperature for 2-hour cracking periods

called strippable carbon, which represents adsorbed and interspersed hydrocarbon gas and liquid remaining with the spent catalyst after the cracking has been accomplished. It is common practice to purge off most of the strippable carbon before the catalyst is regenerated. For the cracking operations reported here, this increment of carbon yield was negligible compared to catalytic carbon.

Although, as mentioned above, the yield of carbon on feed stock at a given temperature is a function of conversion, there is also a well-defined relation between the weight per cent of carbon on catalyst and the catalyst residence time. Important deductions are derivable from the following relations:

Wt. % carbon based on feed = function of feed conversion

Wt. % carbon on catalyst = function of catalyst residence time

Data in fixed-bed and in fluid catalytic cracking are treated separately.

### Carbon Formation in Fixed-Bed Cracking

A considerable amount of data shows that the weight per cent carbon formed on the catalyst is approximately a logarithmic function of the length of time elapsed since the catalyst was freshly regenerated. For a given catalyst, feed stock, and temperature the equation takes the form:

$$C_c = A\cdot\theta^n$$

Two examples of this relationship are discussed.

Example 1 is shown graphically in Fig. 1, which depicts the relation between carbon on catalyst and residence time of catalyst for a West Texas gas oil and a natural (activated clay) cracking catalyst at 850°F. The experiments were conducted in a small fixed-bed unit. Each point on the plot represents a run, either on a fresh batch of catalyst or on one that had very few regenerations. In other words, the level of initial catalyst activity represented by the data was substantially constant.

After the process period had lasted for the time indicated in Fig. 1, the catalyst was purged to remove strippable carbon. Then the catalyst was discharged from the unit, and the carbon on it was determined by combustion of a representative sample. The cracking period lengths included much shorter residence times than are normally employed in fixed-bed cracking, because the experiments were designed to furnish fundamental information. The correlating line on the graph is represented by the equation:

$$C_c = 0.86\,\theta^{0.41} \qquad (1)$$

A second example, also portrayed in Fig. 1, shows the relation between carbon on catalyst and residence time for an East Texas gas oil and a synthetic (silica-alumina) catalyst at 850°F. The results were obtained in small fixed-bed units, on which a study was being made of the effect of feed rate (v/v/hr.) and length of process period ($\theta$). The synthetic catalyst was of such inherent stability that its activity was completely restored after each successive regeneration. Hence the entire study was made on one batch of catalyst. After each process period the catalyst was purged and then regenerated *in situ* by air oxidation. The carbon formation was determined by measuring and analyzing the regeneration gases. Although the accuracy of these determinations was not a particularly high order, a fairly good correlation was obtained between carbon on catalyst and residence time, represented by the following equation:

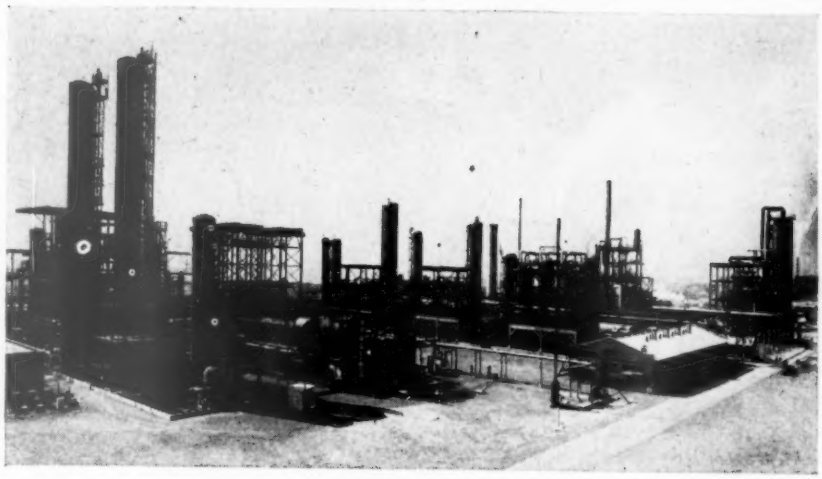
$$C_c = 0.65\,\theta^{0.41} \qquad (2)$$

In the example just discussed for East Texas gas oil and synthetic catalyst, the implicit assumption is made that, within limits, the feed rate has no effect on the extent of carbon formation on catalyst for a given residence time. Although this may appear strange at first, there is a large amount of supporting evidence, some of which follows.

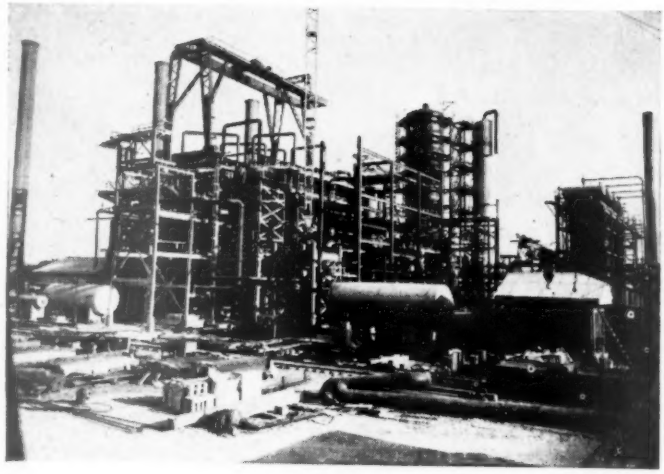
A rather extensive series of runs was made on a small-scale fixed-bed unit on an East Texas gas oil, both with natural and with synthetic catalyst, to determine the effect of feed rate on carbon formation at cracking temperatures from 800° to 950°F. The feed rate was varied from 0.6 to 1.2 v/v/hr., but the length of cracking period was uniformly maintained at 2 hours. After each run the catalyst was discharged from the unit and analyzed for carbon by combustion; and

TABLE I. Fixed-Bed Catalytic Cracking of East Texas Gas Oil for Process Periods of 2 Hours

| Natural Catalyst | | Carbon wt. | | Synthetic Catalyst | | Carbon wt. | |
|---|---|---|---|---|---|---|---|
| Feed rate, v/v/hr. | Temp., °F. | % on feed | % on catalyst | Feed rate, v/v/hr. | Temp., °F. | % on feed | % on catalyst |
| 0.6 | 812 | 3.8 | 5.0 | 0.6 | 808 | 5.8 | 7.9 |
| 0.8 | 811 | 2.9 | 5.1 | 0.8 | 798 | 4.1 | 7.4 |
| 1.1 | 793 | 2.0 | 4.6 | 1.0 | 803 | 3.2 | 7.4 |
| 1.2 | 804 | 2.0 | 5.0 | 1.2 | 801 | 2.7 | 7.4 |
| 0.6 | 862 | 4.5 | 5.7 | 0.6 | 863 | 7.8 | 10.1 |
| 0.8 | 848 | 3.1 | 5.4 | 0.8 | 857 | 5.7 | 9.9 |
| 1.0 | 845 | 2.5 | 5.3 | 1.0 | 852 | 4.2 | 9.4 |
| 1.2 | 840 | 2.1 | 5.4 | 1.2 | 850 | 3.5 | 9.4 |
| 0.6 | 911 | 5.5 | 6.6 | 0.6 | 917 | 9.3 | 12.0 |
| 0.8 | 908 | 4.3 | 6.8 | 0.8 | 906 | 6.8 | 11.9 |
| 1.0 | 904 | 3.3 | 6.7 | 1.1 | 911 | 5.3 | 11.8 |
| 1.2 | 904 | 2.9 | 6.8 | 1.2 | 901 | 4.3 | 11.1 |
| 0.6 | 962 | 6.9 | 8.1 | 0.6 | 964 | 11.2 | 14.0 |
| 0.8 | 958 | 5.2 | 8.2 | 0.8 | 955 | 8.4 | 13.9 |
| 1.0 | 958 | 4.1 | 8.2 | 1.0 | 957 | 6.6 | 14.1 |
| 1.2 | 952 | 3.4 | 8.2 | 1.2 | 956 | 5.5 | 13.9 |



# Oil Refining Equipment



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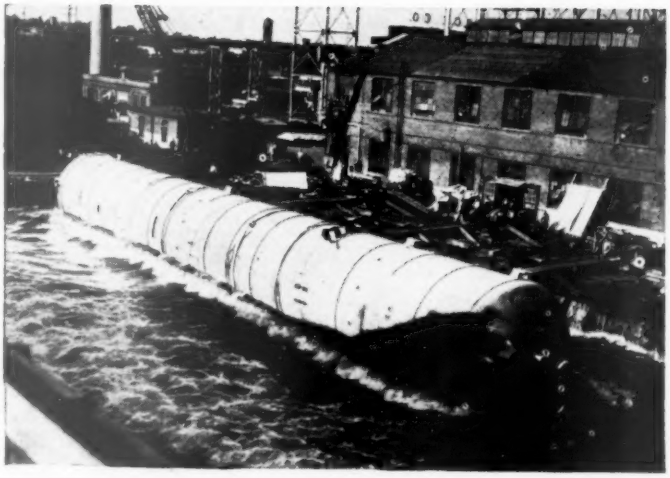

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TABLE II. Fixed-Bed Catalytic Cracking of Cetane and Decalin with Natural Catalyst at 850° F. for Process Periods of 2 Hours

| Feed rate, v/v/hr. | Cetane | | Decalin | |
|---|---|---|---|---|
| | Wt. % C on feed | Wt. % C on catalyst | Wt. % C on feed | Wt. % C on catalyst |
| 0.6 | 4.8 | 4.9 | 3.1 | 3.8 |
| 0.8 | 3.9 | 5.3 | 2.4 | 4.0 |
| 1.2 | 2.5 | 5.2 | 1.6 | 3.7 |
| 2.4 | 1.1 | 4.7 | 0.75 | 3.7 |

a fresh batch of catalyst was installed for the next run. The data are presented in Table I. It will be noted that, as the feed rate increases at a given temperature, the weight per cent carbon on feed decreases as might be expected, but the weight per cent carbon on catalyst remains substantially constant.

Another example of the constancy of carbon formation on catalyst for a given residence time, regardless of feed rate, is furnished by data obtained on catalytic cracking of pure compounds. Both cetane and Decalin were cracked with natural catalyst in a small unit at 850°F. for a process period of 2 hours and at feed rates varying from 0.6 to 2.4 v/v/hr. After each period the catalyst was removed for carbon determination by combustion and was replaced by a fresh charge. The data are presented in Table II. Here again it is evident that the weight per cent carbon on catalyst is relatively independent of feed rate.

A practical demonstration that per cent carbon on catalyst is virtually unaffected by feed rate was furnished some years ago in the operation of a semiplant-scale, fixed-bed catalytic cracking unit. In each reactor there were four catalyst beds of equal height, vertically disposed one above the other. During the process period the flow of oil vapors was through the four beds in series. During regeneration, the flow of gases was through the four beds in parallel in order to minimize pressure drop. The individual temperature records for each bed during regeneration indicated that about the same amount of carbon was burned from each bed. This is equivalent to saying that the carbon on catalyst was independent of feed rate, because the feed-space-velocity (v/v/hr.) in the case of the first bed was four times that for the total reactor.

Much thought and speculation have been directed to answering the question as to why carbon on catalyst for a given residence time should be relatively independent of feed rate. The characteristics of the hydrocarbons in contact with the catalyst are continually changing as the feed stock progresses through the catalyst bed, and also different feed stocks differ in their carbon-forming tendencies. However, consider what happens as the feed stock passes through the bed of catalyst. It is converted to an increasing extent into (*a*) gasoline and gas which have less tendency to carbonize than the original feed and (*b*) cycle gas oil which has more tendency to carbonize than the original feed.

To the degree that these two tendencies balance each other, the extent of carbon formation on catalyst will not differ at any level in the catalyst bed at any given time; this means that carbon on catalyst is independent of feed rate within limits. This phenomenon is thus ascribed to a fortuitous balance between the carbonizing tendencies of the unconverted feed and the total products of reaction. It is not proved or claimed that this observation will hold for all feed stocks, all catalysts, or an extreme variation in feed rates. In fact it seems remarkable that the generalization holds as broadly as indicated by the results presented in this paper.

The data in Table I permit a study of the effect of temperature on carbon formation. Fig. 2 shows how carbon formation on catalyst increases with cracking temperature. The correlation is rather good, and indicates that the carbon formation doubles for approximately 190-200°F. increase in cracking temperature.

As indicated earlier, there is generally a good correlation between feed stock conversion and carbon yield based on feed for a given catalyst, feed stock, and temperature. As an example, the data obtained in a fixed-bed study on East Texas gas oil and synthetic catalyst at 850° and at various feed rates and cracking periods are portrayed in Fig. 3. The runs involved are the same as those already discussed in connection with Fig. 1. Fig. 3 shows a fairly good linear correlation on log-log paper between conversion and carbon yield on feed. The one point considerably off the line, at about 36% conversion, may represent a faulty determination of conversion as discussed later: At this juncture it may be mentioned that numerous other data are available on other feeds, on other catalysts, and at other temperatures, which show that the logarithm of the conversion is approximately linear with the logarithm of the carbon yield (log-log), or that the conversion is linear with the logarithm of the carbon yield (semilog). The graph in Fig. 3 is represented by the equation:

$$C_f = (3.55)(10^{-5})V^{2.93} \quad \ldots\ldots\ldots (3)$$

It is interesting to consider simultaneously Equations 2 and 3, which refer to the same cracking runs. Since the carbon on catalyst is a logarithmic function of length of process period independently of

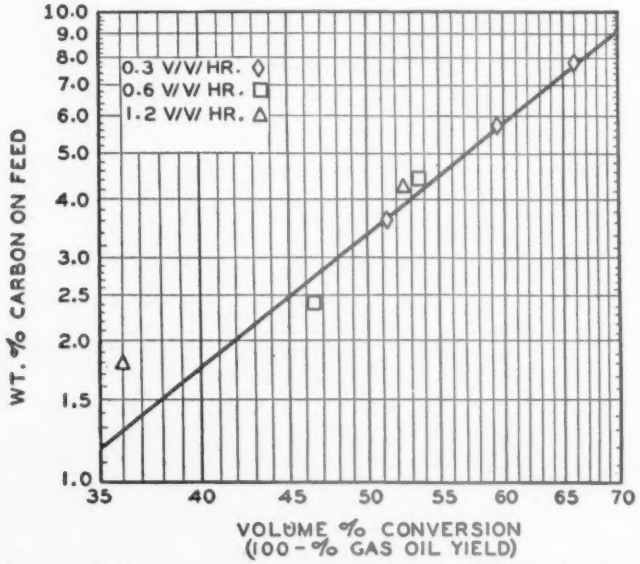


Fig. 3—Carbon yield vs. feed conversion for fixed-bed catalytic cracking of an East Texas gas oil with synthetic catalyst

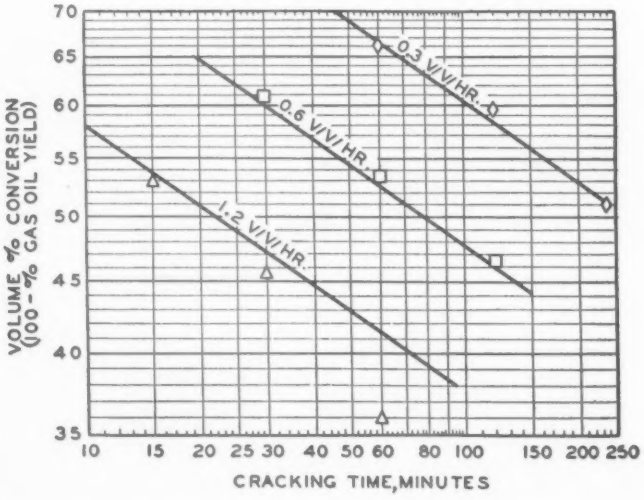


Fig. 4—Feed conversion vs. cracking time and feed rate for fixed-bed catalytic cracking of an East Texas gas oil with synthetic catalyst

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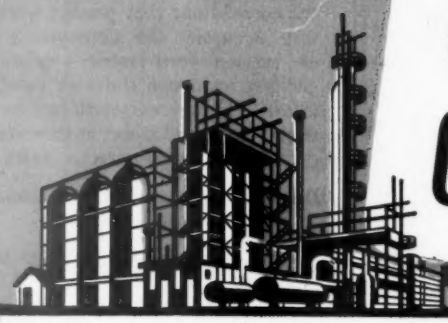

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feed rate, and since the carbon yield based on feed is a logarithmic function of conversion regardless of feed rate or cracking period length, certain significant deductions are possible. Specifically, an equation is developed below to show the interrelation of conversion, feed rate, and length of cracking period:

$$\%\ \text{carbon on catalyst} = C_c = 0.65\theta^{0.44} \quad \ldots\ldots (2)$$

$$\%\ \text{carbon on feed} = C_f = (3.55)(10^{-5})V^{2.93} \quad \ldots\ldots (3)$$

$$C_c = C_f \div (\text{catalyst-to-oil weight ratio}) \quad \ldots\ldots (4)$$

$$= C_f \cdot U \cdot \theta/60 \cdot D_o/D_c$$

$D_o/D_c = 1/0.58$; therefore

$$0.65\,\theta^{0.44} = (3.55)(10^{-5}) \cdot V^{2.93} \cdot U \cdot \theta/60 \cdot 1/0.58$$

whence $V = 96 \cdot 1/U^{0.34} \cdot 1/\theta^{0.19}$ ....(5)

A graphical solution of Equation 5 is given in Fig. 4 for feed rates of 0.3, 0.6, and 1.2 v/v/hr. For comparison, the actual data obtained in the runs are plotted. The concordance between actual and calculated values of conversion is generally good except for the point at about 36% conversion, in which case the predicted value would be 41%. If there had been an error in the determined conversion for this period, and if the predicted value were actually correct, the correlation shown in Fig. 3 would also be considerably improved, as pointed out earlier.

The significance of the correlation among conversion, feed rate, and length of cracking period deserves further mention. First, it is possible from a relatively few runs, with accurate carbon determinations, to establish a good mathematical relation showing the relative effect of feed rate and length of process period in determining conversion. This correlation is readily amenable to linear graphical representation or to simple nomographic treatment, with a fair amount of extrapolation permissible beyond the actual confines of the data.

### Carbon Formation in Fluid Cracking

Some of the differences between fluid and fixed-bed catalytic cracking have already been mentioned. However, the similarities far outweigh the differences; and it has been found that the same generalizations with respect to carbon formation, developed for fixed-bed cracking, are equally applicable to fluid operation.

An extensive study was made in fluid catalyst cracking on a semiplant scale both on natural catalyst and on synthetic. A number of different types of reactors were employed, many feed stocks were studied, and a wide range of operating conditions was covered. Two particular studies have been chosen to illustrate the relation between carbon formation on catalyst and residence time of catalyst.

The first case is for an East Texas gas oil with natural catalyst at a cracking temperature of 900-925°F. The second is for a Tinsley gas oil with synthetic catalyst at 950°. In both cases the catalyst was continuously regenerated to a low residual carbon content, and good stripping of spent catalyst was obtained. The carbon formation thus represents substantially catalytic carbon only. The weight per cent carbon formed on catalyst is the difference in carbon content between spent and regenerated catalyst. Although samples of spent and regenerated catalysts are regularly withdrawn from fluid units for carbon determination by combustion, the absolute value of the carbon content even on spent catalyst is ordinarily so small that erratic results sometimes occur.

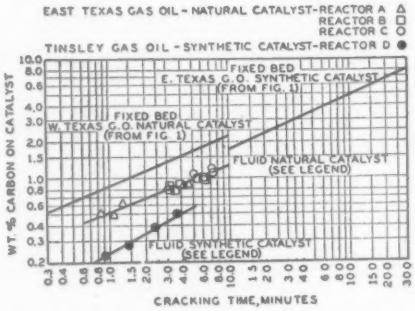
EAST TEXAS GAS OIL - NATURAL CATALYST-REACTOR A
REACTOR B
REACTOR C
TINSLEY GAS OIL - SYNTHETIC CATALYST-REACTOR D
FIXED BED
E. TEXAS G.O. SYNTHETIC CATALYST (FROM FIG. 1)
FIXED BED
W. TEXAS G.O. NATURAL CATALYST (FROM FIG. 1)
FLUID NATURAL CATALYST (SEE LEGEND)
FLUID SYNTHETIC CATALYST (SEE LEGEND)
WT. % CARBON ON CATALYST
CRACKING TIME, MINUTES

**Fig. 5—Carbon formation vs. cracking time in fluid catalytic cracking compared to fixed-bed cracking**

A more reliable determination of the weight per cent carbon formed on the catalyst is obtained by dividing the weight of carbon burned in the regenerator in unit time by the weight rate of catalyst flow. This is the procedure regularly employed. The rate of carbon burning is determined from the quantity and analysis of the regeneration vent gas; and the rate of catalyst flow is determined by Venturi or other special meters. The catalyst residence time in the fluid cracking reactors is determined from the average catalyst concentration and the catalyst flow rate. The catalyst concentration is calculated by pressure drop measurements across various levels in the reactor.

The relation between carbon formation on catalyst and residence time of catalyst is illustrated in Fig. 5, which also includes the previous correlations from fixed-bed cracking given in Fig. 1. The study on the East Texas gas oil with natural catalyst at 900-920°F. (Fig. 5) was conducted in three reactors of different shape factors, employed in a special investigation of reactor type. The various points represent data at approximately the same level of catalyst activity. No difference is indicated for the various reactors. The equation for the correlating line is:

$$C_c = 0.52\,\theta^{0.38} \quad \ldots\ldots (6)$$

In the case of the Tinsley gas oil with synthetic catalyst at 950°F., the points in Figure 5 were corrected to a common activity level. The correlating line is represented by the equation:

$$C_c = 0.24\,\theta^{0.53} \quad \ldots\ldots (7)$$

In fluid catalyst cracking, as in fixed-bed, the carbon yield based on feed is a function of feed stock conversion. Hence it is possible to derive the same kind of equations relating conversion with feed rate (w/hr./w) and catalyst residence time or catalyst to oil ratio. Such equations have been used to construct graphical correlations that predict with satisfactory accuracy the conversions obtained at various feed rates (w/hr./w) and catalyst residence times or catalyst to oil ratios. These correlations have been particularly valuable in the analysis of data from the commercial units.

### Relation Between Carbon Formation and Residence Time

The very small temperature coefficient of carbon formation (Fig. 2) is indicative of a diffusion control, and since the rate of carbonization drops off as the percentage of carbon on the catalyst increases, it is reasonable to postulate that the coke itself is the diffusion barrier. Indeed, if it is assumed that the rate of diffusion is inversely proportional to the weight per cent of carbon, then

$$dC_c/d\theta = K/C_c$$

or

$$C_c = A\cdot\theta^{0.5} \quad \ldots\ldots (8)$$

It is of interest to compare Equation 8 with the four correlation equations depicted in Fig. 5, two for fixed-bed cracking and two for fluid:

$$C_c = 0.86\theta^{0.41} \quad \ldots\ldots (1)$$
$$C_c = 0.65\theta^{0.44} \quad \ldots\ldots (2)$$
$$C_c = 0.52\theta^{0.38} \quad \ldots\ldots (6)$$
$$C_c = 0.24\theta^{0.53} \quad \ldots\ldots (7)$$

The exponents of $\theta$ are all close enough to 0.5 to suggest a good concordance with the theory advanced above.

Just how the coke constitutes a diffusion barrier is not entirely clear, since the large specific surfaces of cracking catalysts require a large coke deposition to form even a monomolecular layer. Possibly the coke accumulates about active centers on the surface causing an effective diffusion choke while most of the surface is still bare.

#### Nomenclature

- $A$ = constant, depending on catalyst, feed stock, and temperature
- $C_c$ = carbon, weight per cent on catalyst
- $C_f$ = carbon, weight per cent on feed
- $D_o$ = density of oil
- $D_c$ = density of catalyst
- $K$ = constant ($=A^2$)
- $V$ = volume per cent conversion of feed stock
- $U$ = feed rate, volumes/volume of catalyst/hour
- $W$ = feed rate, weight/hour/weight of catalyst in reactor
- $Z$ = weight ratio of catalyst to oil
- $\theta$ = catalyst residence time, minutes
- $n$ = constant, depending only slightly on catalyst, feed stock, temperature

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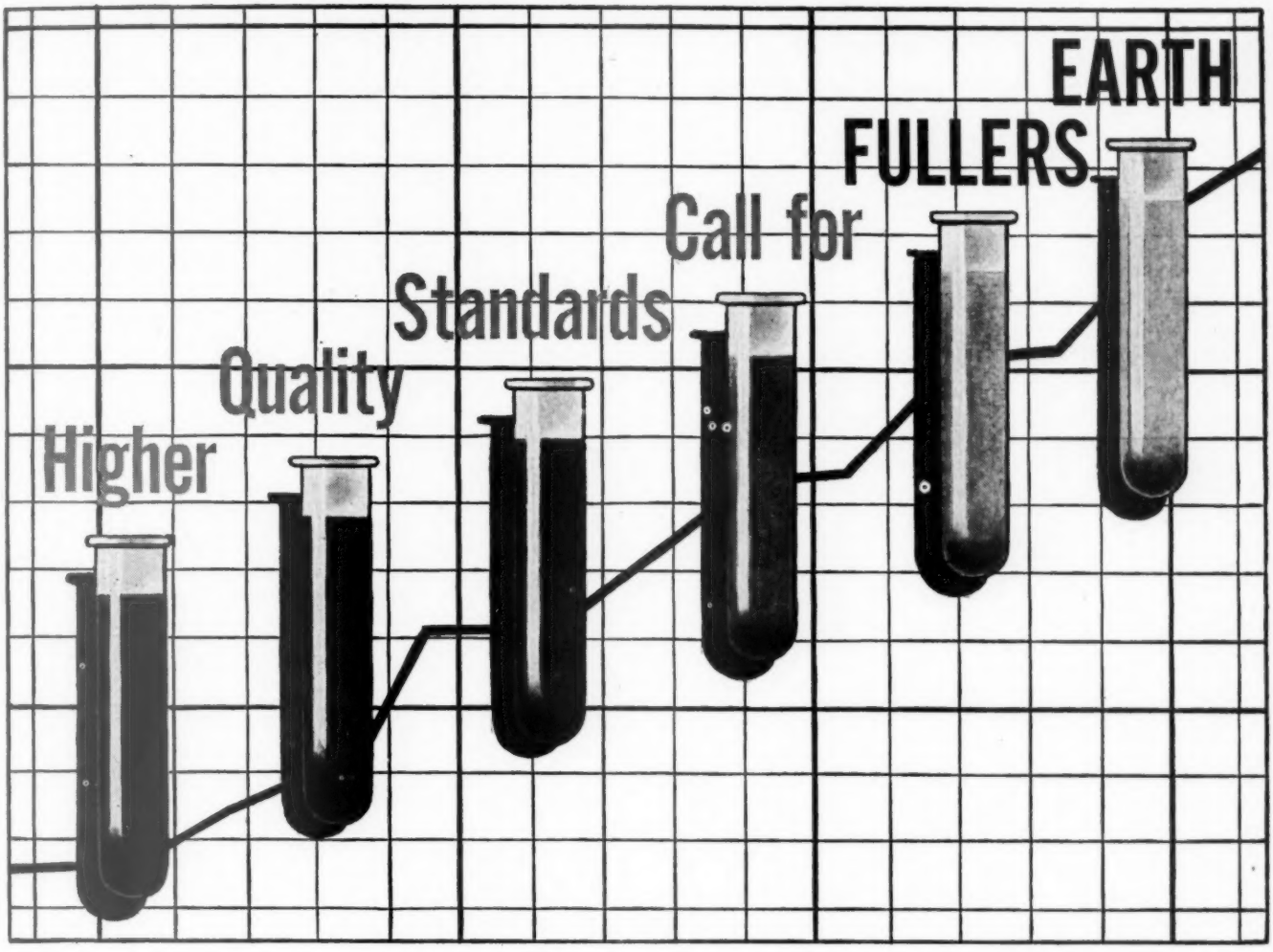


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R-703

# INDUSTRIAL LUBRICATION

*By W. G. Forbes*

## 5—Lubrication of Ball and Roller Bearings

**W. G. Forbes, who has been contributing this regular feature to the *NPN Technical Section* since last May, was drowned July 29 (See *NPN*, Aug. 1, 1945, pg. 4). He was Lubricating Engineer for the Tide Water Associated Oil Co., New York.**

**Before his death, however, Mr. Forbes had prepared a number of installments of his material in advance and submitted them to the editors. We will attempt to continue presenting his valuable contributions to the literature in the field of industrial lubricants and industrial lubrication as long as they are available.**

*Q—How often should the average ball or roller bearing be greased?*

A—Every 2 or 3 months a small amount of grease should be added to most bearings, approximately a thimbleful for the average electric motor bearing. Much depends upon the type of operation, temperature of the surroundings, and so on, but under no circumstances should anti-friction bearings be packed tight with grease. At speeds above 500 rpm the bearing quickly gets rid of the chocking excess, and in so doing the fluid friction that results may raise the temperature 50°F., and then nearly all the grease will either run out or be thrown out by centrifugal force.

Many ingenious devices and schemes have been worked out to prevent damage from the careless practice of chocking anti-friction bearings with grease, but such innovations are only partially successful against a grease gun that can exert a pressure of several hundred pounds to the square inch.

*Q—What type of grease would be suitable for a roller bearing operating in surroundings where the temperature is normally 180 to 200°F.? The shaft is 4 in. in diameter and the speed is 300 rpm.*

A—If this bearing were oil lubricated it would require a heavy oil to counter the thinning effect of the high temperature, say an oil having a Saybolt viscosity of about 125 sec. at 210°F. Hence a similar oil would be required in the grease.

The next consideration would be the type of soap. Since soda soaps impart a melting point of about 350°F. they are used extensively for making greases that are to be used in warm surroundings. Other soap bases might also be used with high melting point characteristics, but the soda types are the most common.

Lastly, the consistency would have to be about No. 2 for use in a grease gun, while No. 3 or a stiffer consistency could be used if the bearing or bearings were equipped with grease cups.

*Q—What approximate rotational shaft speed is generally considered to be the limit for grease-lubricated ball and roller bearings?*

A—The answer to this question is somewhat controversial but a maximum of 2,400 rpm is a rough estimate. At higher speeds the centrifugal forces are generally sufficient to throw the grease off the shaft, or race, at a rate which is faster than the grease can bleed back into the shaft in a quantity sufficient to maintain adequate lubrication. If a shaft is 5 in. in diameter and turns 2,400 rpm, the surface speed is about 3,000 feet a minute. Hence it would probably be found that oil supplied by a wick feed or similar method would be more satisfactory than grease for such an application. On the other hand if the shaft is 2 in. in diameter and turns 2,400 rpm, the surface speed of the shaft is only about 1,200 feet a minute and a soft grease would be satisfactory for this application, assuming, of course, that the bearing is equipped with suitable seals to prevent loss of the grease.

*Q—What general properties are required in a grease that is to be used for electric motors equipped with ball bearings?*

A—Greases are soap thickened mineral oils and the first requirement is to use a grease containing an oil of suitable viscosity, because the oil lubricates the moving parts of an anti-friction bearing, not the soap. The great majority of electric motors operate at speeds between 750 and 1800 rpm, hence an oil having a Saybolt viscosity of about 300 sec. at 100°F. (light SAE 20) would be suitable for this general range.

The next consideration is the type of soap base. Most greases manufactured for ball and roller bearings contain two types, lime soap, which imparts a buttery texture, and soda soap, which imparts a stringy texture and also raises the melting point to about 250 to 300°F. The combination of these two types gives a grease that has the virtues of both soaps, not too stringy so that the grease will not impart an excessive dragging action, and not too buttery in texture so that the grease will not channel.

The last important property is that of consistency. In this connection the grease should be of No. 2 consistency, which is soft and suitable for use in either a hand operated grease gun or a pressure grease gun.

Ball and roller bearing greases may contain other ingredients such as an oxidation inhibitor to help retard the natural process of oxidation, but in no case should the grease contain "fillers" such as talc, graphite, etc. Fillers of this type have a lumpy nature.

*Q—When are lime soap greases used in ball and roller bearings?*

A—Lime soap greases have a buttery texture which makes them channel easily in anti-friction bearings but the soft grades are suitable for bearings operating below 500 rpm where the pressures are moderate. Lime soap greases are also adapted to wet operating conditions because this type of grease is water repellent. Their melting point is about 200°F. so they cannot be used at temperatures much above 140°F. or so, but for automatic packaging machines and similar machines which do not operate at high speeds this type of grease will give satisfactory service.

*Q—If a grease is advertised as having a melting point of 400°F. does this mean that it would be suitable for continuous operation at 300 to 350°F.?*

A—The answer to this question is "No." There is no grease made that can withstand a continuous operating temperature of 300°F. for any appreciable length of time. High-melting point greases are suitable for operating temperatures up to about 200°F. or perhaps a little above, but they are only adapted to withstand higher temperatures for a short length of time, say a few minutes. The process of oxidation soon produces rapid deterioration at operating temperatures above 200°F. Hence the grease should be replenished frequently.

Perhaps a good illustration of the benefit of a high melting point grease is to be found on grease-lubricated table roll bearings in steel mills. Here the hot slabs of steel are moved along a series of rollers, at times being brought to a stop for a few minutes with the result that the bearings on the rollers below are subjected to considerable heat. Under these conditions a high-melting point grease will greatly aid in preventing the grease from running out of the bearings.

# Analysis of Light Constituents in Crude Petroleum By Low-Temperature Fractional Distillation

*By R. J. Askevold and M. S. Agruss*

IN THE calculation of material balances on distillation and cracking units in oil refineries, it is often desirable to know the composition of the light gases occurring in the original crude oil charge. This is particularly important at present because of the increasing use of these materials in the production of aviation gasoline.

The low-temperature fractional distillation columns commonly used for gas analyses are not entirely suitable for determination of the light constituents in crude oil because of the small quantities of these gases present.

Difficulty is also caused by the fact that most crudes contain some water, which tends to collect and freeze in cold portions of the column, causing partial plugging and consequent flooding.

The method here described is particularly suited for laboratories where such analyses are but seldom required and where regular debutanizing equipment is not available. Considerable time is saved, compared to operation of a pilot still.

The apparatus permits the use of a crude oil sample sufficiently large to provide measurable quantities of butane and lighter gases for distillation in an ordinary low-temperature fractional distillation column, and at the same time removes water from the portion of the sample which enters this column.

Fig. 1 illustrates the auxiliary still which may be used in conjunction with any low-temperature fractional distillation column having a still body of 20-ml. capacity or more. Before an analysis, the column of the auxiliary still is filled with sodium hydroxide pellets to form the packing, and pellets are placed in the flask to act as boiling stones. The entire system is evacuated to a pressure of less than 1 mm. of mercury, by means of the pump regularly used with the gas-analysis equipment.

The reflux condenser of the low-temperature column is cooled below the boiling point of methane, and a Dewar flask containing acetone and dry ice is placed around the inlet tube of this column. The crude oil sample bomb is then connected to the inlet stopcock of the auxiliary still, and sample is slowly introduced to the flask by means of this stopcock. Immediately after sampling is finished, the electric heating is started to strip light constituents from the crude oil.

During distillation through the pellet-packed column, water and hydrogen sulfide will be removed; heavier hydrocarbons will condense in the still kettle

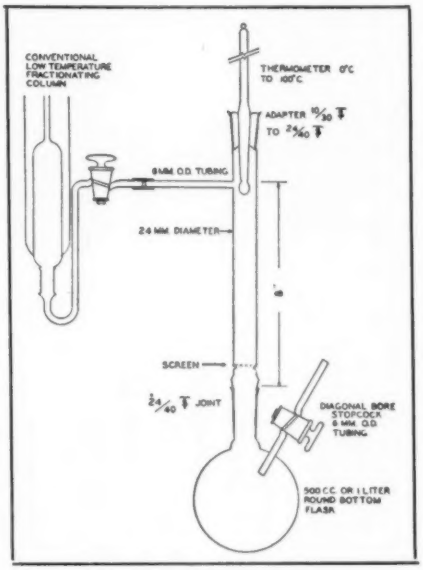
CONVENTIONAL LOW TEMPERATURE FRACTIONATING COLUMN
THERMOMETER 0°C TO 100°C
ADAPTER 15/30 T TO 25/40 T
6MM O.D. TUBING
24 MM. DIAMETER
SCREEN
25/40 T JOINT
DIAGONAL BORE STOPCOCK 6 MM. O.D. TUBING
500 CC. OR 1 LITER ROUND BOTTOM FLASK

**Fig. 1—Auxiliary still used in conjunction with low-temperature fractional distillation column for analysis of light constituents in crude oil**

of the low-temperature column, and lighter ones will be refluxed by the cold reflux condenser.

Heating of the auxiliary still should be slow enough for good fractionation, but should be continuously increased, to ensure a slightly higher pressure in the auxiliary still than in the low-temperature fractional distillation column at all times; reversal of this pressure differential will cause some of the cold condensate to flow back into the auxiliary column, with rapid vaporization and a violent pressure surge.

If the pressure in the low-temperature fractional distillation column reaches atmospheric during the period of crude-stripping, methane is distilled off at a rate sufficient to maintain atmospheric pressure.

The crude may be safely assumed to be free of butane and lighter gases when the temperature indicated by the thermometer at the top of the auxiliary column reaches 55°C. At this point the electric heater is lowered and the connection closed between the two columns.

The condensate in the column is fractionated in the usual manner to separate methane, ethane, propane, isobutane, and *n*-butane, after which the residue of pentanes and heavier is distilled back into the stripped crude oil by cooling the auxiliary still with dry ice.

The weight of each light hydrocarbon may be calculated from the amount distilled, and the weight percentage of each obtained on the basis of the water- and hydrogen sulfide-free crude oil, by weighing the crude residue. If it is desired to fractionate the stripped residue to obtain further data, the flask containing this residue may be transferred to any suitable crude assay column, and distillation continued.

Using the auxiliary still described in this paper, a number of analyses have been made on batches of crude oil, which were also distilled in a pilot-size batch debutanizing still, with a 18.9-liter (5 gallon) stainless steel kettle, 180-cm. (6-foot) saddle-packed glass column, and refrigerated total condenser capable of refluxing propane. Such distillations yielded completely debutanized straight-run gasoline, and the gases were measured and collected in a gas holder. Analytical results on these relatively large volumes of gas, when calculated to the basis of the crude, show good agreement with analyses described here, shown in Table 1.

TABLE 1—Typical Analyses on Crude Oils

| | Michigan | | Van Zandt | | Cabin Creek | | Eureka | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| Methane | 0.00 | 0.00 | 0.00 | 0.00 | Trace | Trace | Trace | Trace |
| Ethane | 0.00 | 0.01 | 0.01 | 0.02 | 0.04 | 0.06 | 0.02 | 0.02 |
| Propane | 0.16 | 0.14 | 0.16 | 0.16 | 0.39 | 0.49 | 0.25 | 0.25 |
| Isobutane | 0.11 | 0.09 | 0.33 | 0.36 | 0.44 | 0.50 | 0.35 | 0.22 |
| *n*-Butane | 0.48 | 0.46 | 0.53 | 0.43 | 1.08 | 1.14 | 0.66 | 0.65 |
| Pentanes + | 99.25 | 99.30 | 98.97 | 99.03 | 98.05 | 97.81 | 98.72 | 98.86 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

| | Corning | | Mid-Continent | | Creole | | Cumberland | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| Methane | Trace | Trace | 0.00 | 0.00 | 0.01 | Trace | Trace | Trace |
| Ethane | 0.04 | 0.03 | 0.02 | Trace | 0.04 | 0.01 | 0.03 | 0.04 |
| Propane | 0.22 | 0.22 | 0.22 | 0.25 | 0.09 | 0.07 | 0.48 | 0.45 |
| Isobutane | 0.25 | 0.18 | 0.28 | 0.25 | 0.05 | 0.04 | 0.25 | 0.29 |
| *n*-Butane | 0.51 | 0.49 | 1.18 | 1.13 | 0.08 | 0.04 | 1.15 | 1.09 |
| Pentanes + | 98.98 | 99.08 | 98.30 | 98.37 | 99.73 | 99.84 | 98.09 | 98.13 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

A. Proposed method.
B. Debutanizer method

*This paper was originally presented before the Division of Petroleum Chemistry at the 105th meeting of the American Chemical Society, Detroit, April 13, 1943, and is reprinted from the April 15, 1945, issue of Industrial and Engineering Chemistry. Both authors are associated with the Pure Oil Co., Chicago.*

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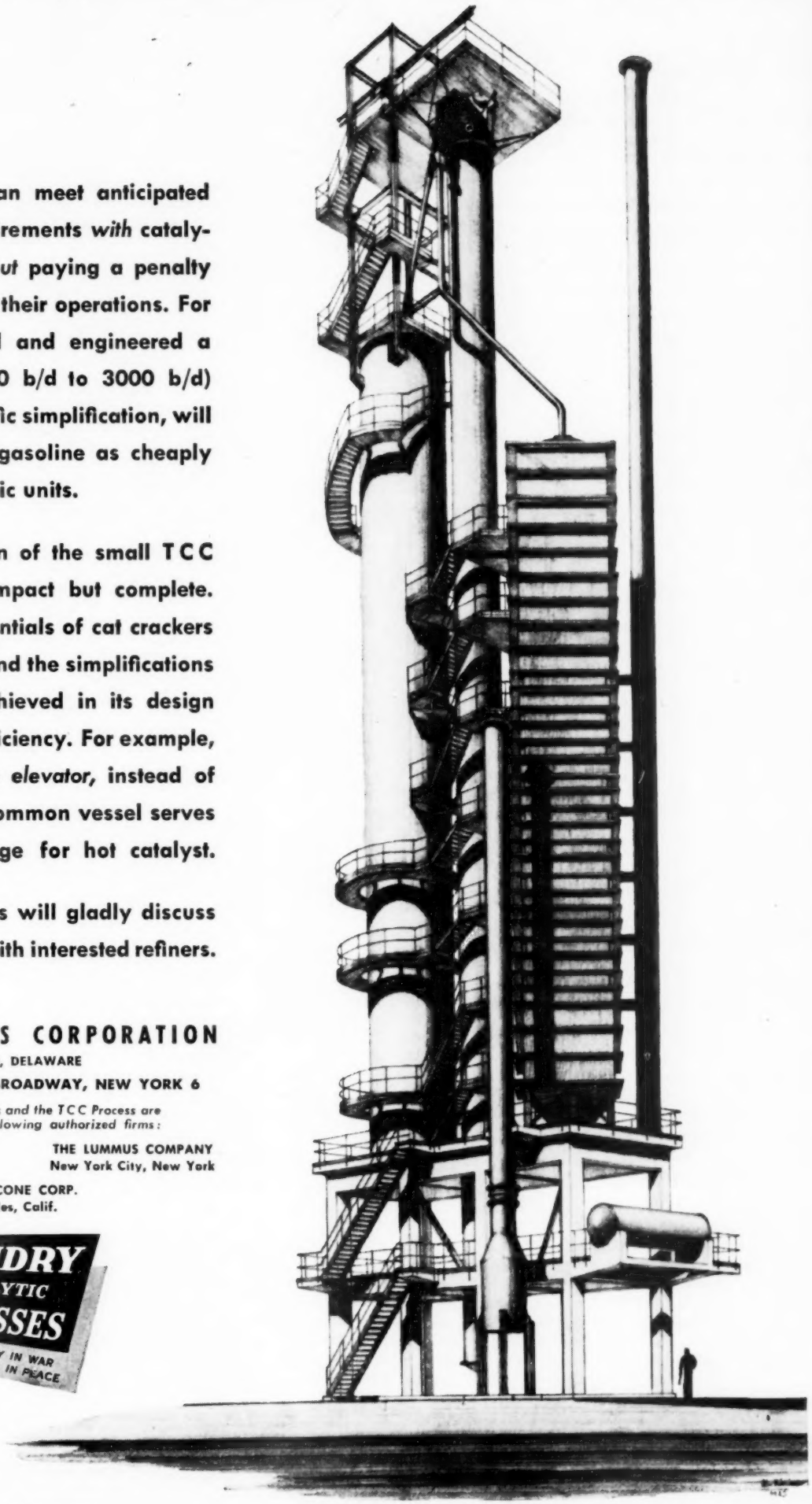

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# My Trip to the 'Lab'

**Men who toil on research projects in oil company laboratories, and undoubtedly those of other industries as well, as a rule put their hearts as well as their minds and their professional technique into their work. So it is not out of the ordinary that the laboratory, or, affectionately, the "lab", seems itself to take on certain personal characteristics from the sweat and hopes and inspiration of the men who work within its walls that other departments of an industrial concern but seldom inherit.**

**Even like an individual, the "lab" sometimes takes itself too seriously. The head of the research laboratory of a large oil company reflects this impression in the accompanying contribution sent to NPN's Technical Section. It is by his request that the authorship is anonymous.**

I HAVE never succeeded in getting on really intimate terms with my office. It maintains an air of kindliness but of patronizing formality toward me. For the life of me, I cannot take any liberties with it. I could never refer to it, even in my most confident moments, as the "good old 'off'."

I have friends who spend all their time in factories, but they never get well enough acquainted to talk about the 'fac'."

Accordingly my interest was at once aroused when a good friend of mine in the Mammoth Oil Corp asked me whether I would like to take a trip with him "out to the 'lab'."

I knew he had reference to the famous Research Laboratory, full of bewildered scientists, shiny glassware, hopelessly complicated instruments, and filing cabinets, crammed with unintelligible charts, words, and numbers. I agreed to go on one condition—that nothing be explained to me. I can always manage to look intelligent except when I am listening to an explanation.

The day of adventure finally arrived.

"How can we get out to the 'lab'?" I asked.

"That's easy," my friend replied. He lifted the phone, dialed a number and asked for Dr. Topp. In a few moments all was arranged. Dr. Topp was to drive his car downtown for us, and then drive us out.

"But that will make a 50-mile drive for him", I observed. "Isn't he a vice-president or something?"

"Oh, Bill won't mind. He'll probably drive us downtown again, and that will make it an even 100 miles! Bill won't mind."

### Nothing Better to Do

Pretty soon Dr. Topp arrived. He was a genial man who promptly put us at our ease by protesting that he really had nothing more pressing to occupy his time than to entertain strangers who were wholly lacking in technical appreciation.

"You may not be able to read the score of a symphony," he observed, "but you can enjoy the performance."

I tactfully withheld the shameful admission that I have no ear for music, either.

On the way out, I asked Dr. Topp why a laboratory should be regarded with affectionate indulgence even by those like myself who are not even distantly related; for even now I was talking about the "lab" as though it were my own daughter.

"It's this way", he said, "you cannot always trust a 'lab,' but it always trusts you. Sometimes a 'lab' will explode right in your face. You may not like this in every way, but there is something delightfully informal about an explosion. At times a 'lab' is perfectly tractable, and then we become suspicious. But through it all the 'lab' has a touching confidence not only in its workers but in its most casual friend. And there is nothing more endearing than this absolute trust."

Before I could find out how this trust manifested itself we had arrived. I'm sure the "lab" winked at me as we entered the gate.

"I hope the 'lab' is in one of its more gentle moods today," I observed, "even if fundamentally treacherous."

Dr. Topp paid no attention, but conducted us to his office.

"What would you like to see first?" he asked.

"I notice in the papers," I said, "that you have made many inventions that are used in the petroleum industry. Would you mind not showing me these?"

### Desk Clear, Except for Feet

Dr. Topp was modesty itself. He seemed actually relieved, and took me in to meet Dr. High, who graciously put down his newspaper and talked to us for a while with his feet on an otherwise perfectly clear desk. Dr. High seemed to take great pride in the fact that his men knew more than he did and could prove it. He made me feel quite comfortable by telling about the positively disastrous effects of too much information, and the astonishing lengths to which a research executive will go to avoid it.

"Now I want you to meet a production man," said Dr. Topp, and took me in to Dr. Big who greeted us from behind a desk loaded with papers. I sensed that he was a little distraught, in a quietly determined way, and I was not surprised when I learned how much he knew about the areas of the United States where you won't find oil if you drill deep enough.

I learned from him that there is some sort of distinction between the geophysicist and the geologist. At one time the geologists were needed to find oil but the geologists could not get control of production until the wild-catters died off. Then the geophysicists had to be used to find oil, but the geologists are only now beginning to die off. So the geophysicists will take control at about the time when there is not much more oil to find. Ho-Hum. I suppose it is this sort of thing that makes the oil business so exciting and profitable.

I was aroused from my meditations by the sound of many men coming down the corridor. There was something purposeful and stern about the way they walked.

"Where are all these men going?" I asked.

"To the conference room," said Dr. High who had rejoined us. "There are two schools of thought on one of our problems. The faction led by Dr. Small thinks it will, while the other faction thinks it won't. They are holding a conference, not to find out who is right, but to see which side has the best arguments. It will be the 'lab,' of course, that will have the final word."

The men in the conference room were debating more and more earnestly, and words rose to a crescendo of confusion. Suddenly, from a distant part of the "lab," there came the horrid shriek of disintegrating metal, followed by a reverent silence in the conference room.

"Is the 'lab' mad about something?" I ventured.

"Certainly not," smiled Dr. Topp uncertainly.

### The "Lab" Speaks

"The 'lab' has spoken," said Dr. High, "and Dr. Small was right as usual. He said it would and it did. There is only one man in the 'lab' who is right more often than Dr. Small, and that is Mr. Tiny."

The men went quietly back to work.

"It's getting late," said Dr. Topp, "Perhaps we'd better start back to town."

"But I haven't met Dr. Huge," I cried, "and I wanted especially to meet him."

Dr. Topp had a rather vague expression in his eyes. "Dr. Huge?" he questioned.

"Why yes," I explained. "He is one of your vice-presidents."

Dr. Topp was quietly thumbing through a booklet he had taken from his pocket. Finally he looked up brightly.

"I've found it," he said. "I remember now. As a matter of fact I have met him a number of times."

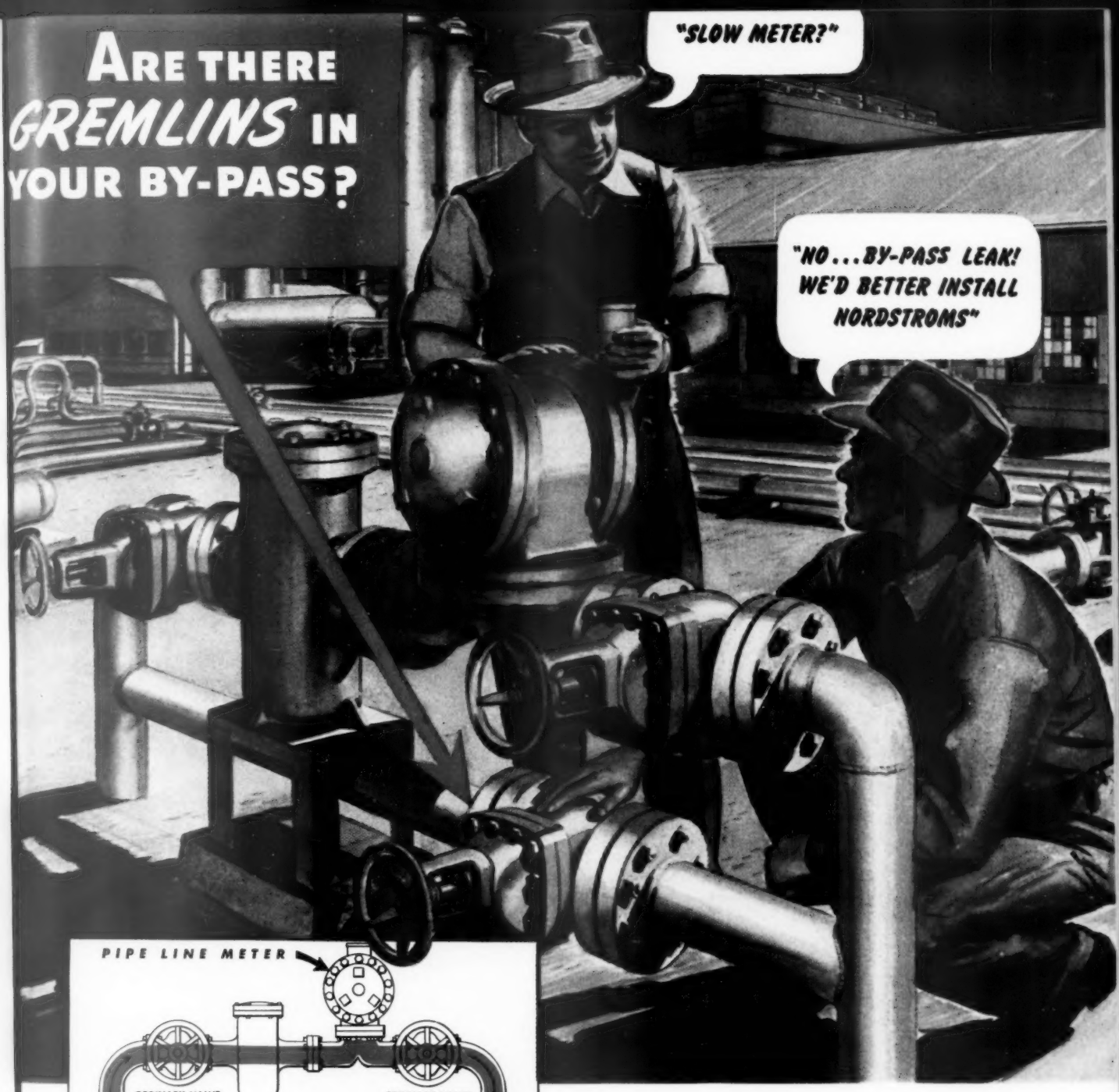
"And he is reputed to have a 'lab' of his own somewhere in the West," said Dr. Big. "A very good 'lab,' they say."

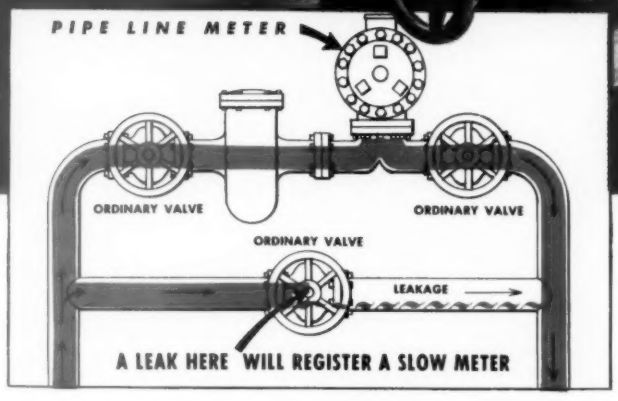
"A man of unusual ability," murmured Dr. Topp, a little reminiscently, it seemed to me.

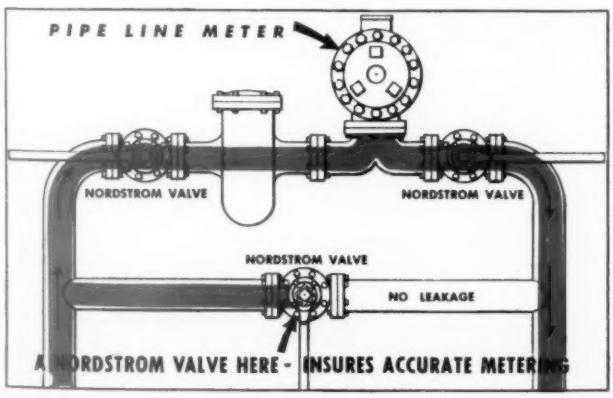
I swear that, when we passed out through the gate, the "lab" threw a raspberry at me.

Looking back on my trip, I think that the thing that stands out most prominently is this—I was not really introduced to the "lab" at all. I would probably not recognize it if I met it tomorrow. Nevertheless, more than ever, I feel a comradeship with it and a curious desire somehow to justify its trust in me. Good old "lab!"

# ARE THERE *GREMLINS* IN YOUR BY-PASS?




## LEAKY VALVES ON BY-PASSES CAUSE INACCURATE METERING

LEAKING gate valves on by-passes cause under-registration of the meter. This is especially true on pipe lines and at pipe line terminals using large oil meters. Losses can run as high as 5% to 10%. Unless the operator is aware of this leakage, the meter is usually blamed for inaccuracy. It isn't the meter's fault. A tight, leak-proof valve on the by-pass is absolutely necessary.

To assure complete satisfaction from any meter setting, use Nordstrom Valves on the by-pass. Not a drop of the line fluid (or gas) can pass a closed Nordstrom. If your meters are running slow, check your by-pass. *Change to Nordstroms.* Gas companies have learned by experience that Nordstrom Valves are essential on the by-pass. Many gas operators have made Nordstroms standard equipment for all meter settings.

**NORDSTROM** *Lubricated* **VALVES**

# A valve principle, centuries-old, becomes indispensable in many plants

OLDEST of devices used by man for the control of fluids in closed conduits is the tapered plug valve. In the form of the common "stop-cock" it has been in general use since very early times, but only in the smaller sizes and for moderate services.

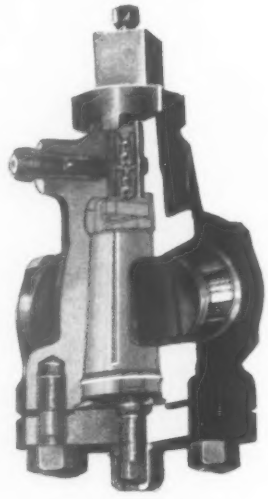
It was not until the advent of the Nordstrom pressure-lubrication principle (1916) that the plug valve became available for the full range of heavy-duty process and industrial uses. Since that time, this principle has been built into Nordstrom Valves of many sizes, styles and materials to meet the demands of practically every branch of the piping industry.

### FUNCTIONS OF VALVE LUBRICATION

The functions of pressure lubrication in Nordstrom Valves are: (1) *Hydraulic action,* keeping the plug in free working condition; (2) *Maintenance of positive seal* against internal and external leakage; (3) *Free turning,* even of the largest sizes and against heavy differential pressure; (4) *Protection of working surfaces* from wear and corrosion. Thus, the Nordstrom principle of lubrication has made it possible to take full advantage of the inherent simplicity, compactness and positive rotary action of the tapered plug valves.

***LUBRICATION IS VITAL***

***Lubrication of a tapered axle skein is necessary for easy rotation and long life of the metal contacting surfaces. Lubrication is even more important in a valve. For extra long life lubrication must be used.***



***Hypreseal Type***

### TAPERED PLUG

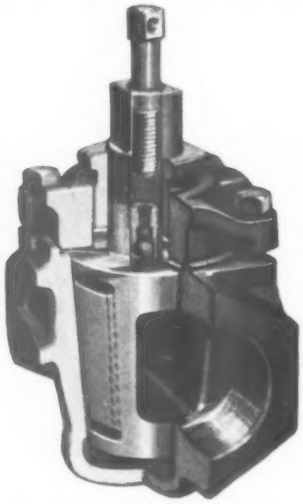
The tapered form of plug and seat provides an intimate fit, regardless of the thickness of lubricant film. Even with a complete absence of lubricant, the plug and body have a ground-joint, metal-to-metal contact. The positive rotary action of the tapered plug valve provides inherent protection of the seating surfaces against corrosion, erosion or accumulation of solids.

### LUBRICANT "JACKING"

In all Nordstrom Valves, lubricant forced in under pressure produces a momentary lifting movement of the plug, which overcomes any adhesion and, because of the taper, creates a small space for a lubricant film between the plug and body.

### RESILIENT SEATING

In every type of Nordstrom Valve, the arrangement which holds the plug in place has a small, but highly important, degree of resiliency. This prevents binding and allows the lubricant "jacking" action to function properly.



***Regular Screwed Gland Type***

### "SEALDPORT"

In the Nordstrom patented *"Sealdport"* system, the grooves are divided between the body and plug in such manner that the exposed groove sections are disconnected from the lubricant supply before they are brought in contact with the line-fluid space. These grooves are automatically reconnected when the plug is brought to the fully open or closed position. Ports are completely surrounded by a lubricant film, preventing leakage past any part of the port boundary.

# Nordstrom LUBRICATED VALVES

*Sealdport Lubrication*

**MERCO NORDSTROM VALVE COMPANY** — *A Subsidiary of Pittsburgh Equitable Meter Company*

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EMCO Regulators • Pittsburgh-National Meters for Gasoline, Grease, Oil, Water and other Liquids • Stupakoff Bottom Hole Gauges

# SYNTHETIC LIQUID FUELS PROGRAM

## Chief of Fuels Branch of Bureau of Mines Reports on Plans for Research and Demonstration Plant Projects on Coal Hydrogenation, Gas Synthesis, and Oil Shale Mining, Retorting and Refining

*By Arno C. Fieldner*

**While the U. S. Bureau of Mines had previously carried on small scale research on synthetic liquid fuels, in anticipation of a future deficiency in petroleum supplies, a broad and comprehensive program is already under way, provided by special legislation passed in 1944.**

**Included is intensive work in the direct hydrogenation of coal and lignite and in the gas synthesis process for the conversion of coal, coke, lignite, natural gas and other carbonaceous materials to liquid fuels; as well as on processes for the recovery and refining of oil from shale. The early development and pilot plant work is for the purpose of providing new and improved procedures for demonstration plants of up to 200 b/d capacity for coal hydrogenation and gas synthesis. Site has already been selected for a demonstration plant to mine and process 200 tons a day of oil shale. Details of the work to date are described and the future program outlined.**

IN 1936 the Bureau of Mines designed and constructed a laboratory-scale experimental coal-hydrogenation plant which has a capacity of about 100 lbs of coal, producing about 8 gal of gasoline per 24 hours. The main objective of plant operations thus far has been to study the hydrogenating properties of coals from the more important coal beds in the U. S.

Sixteen coals have been assayed. The assay consists in determining the maximum quantity of an oil containing 20% of gasoline and 80% of oils boiling below 650° F. which can be produced in a single pass through one converter.

In the experimental plant, coals that contained more than about 7% of ash were difficult to hydrogenate. It is also known from laboratory tests in small bombs that coals containing more than about 85% carbon are difficult to liquefy. It is therefore desirable to avoid high-ash and high-carbon coals in selecting a coal for liquefaction.

Low-ash subbituminous coals and lignite, which comprise 50% of the national coal reserves, were easy to liquefy, although the yields were only half that of high-rank bituminous coal. However, this lower yield may be compensated by low-cost strip mining.

Coal hydrogenation also provides an important source of organic chemicals of commercial value, such as tar acids (phenol, cresols, and xylenols) for plastics and benzol, toluol, and xylol for explosives manufacture and solvents. The yields of tar acids and tar bases are about 10 times those obtained in coal carbonization.

### Gas Synthesis

In 1928 to 1930 the Bureau of Mines developed an active iron-copper catalyst for the gas synthesis process. Because of lack of funds, this research was discontinued. In 1942 funds were appropriated by Congress for further experimental work on this process. About 6 months of experimental work on iron and cobalt catalysts was done in 1942 to 1944, using three shifts a day and six catalyst-testing units. An engineering laboratory for development of process improvements and for pilot-plant operation on the scale of a few quarts of oil a day was completed and operated for about 8 months.

In spite of the fact that this testing has been on a very small scale, the results have been promising, both with respect to the development of better catalysts and in the simplification of the engineering design of the plant. Changes in either factor can reduce the initial cost of the plant and ultimately the cost of the final product. Development of better methods of removal of heat from the synthesis reactions can materially reduce the size of the converters. Improvement in the catalysts can speed up the reactions and may make it possible to produce a good Diesel fuel or a high-octane gasoline at will.

### Need for Enlarged Program

This was the status of the Bureau of Mines research on synthetic liquid fuels at the end of the fiscal year ended June 30, 1944. It was conducted on a purely laboratory scale to aid in the evaluation of foreign developments and to determine the suitability of American coals and lignites for these liquefaction processes. When the research was started in 1937 it was thought that American petroleum reserves were ample and that there would be no need for the early establishment of a synthetic liquid fuel industry. However, it was realized the time would come when gradual exhaustion of domestic petroleum reserves would require supplementing the constantly increasing demand for gasoline and Diesel oil with liquid fuels from other sources.

Since 1937 the rate of discovery of new pools of oil has declined materially and the war has emphasized the fact that oil is the prime essential of modern warfare and that foreign sources of crude oil might not be available in another war. Congress recognized this situation and in 1944 passed Public Law 290 (78th Congress, Chapter 172—2D Session, S.1243) authorizing the Secretary of the Interior, acting through the Bureau of Mines, to construct and operate demonstration plants to produce synthetic liquid fuels from coal, oil shales, agricultural and forestry products.

This law was passed following hearings before a special Congressional subcommittee in August, 1943, in Washington, Pittsburgh, Salt Lake City, and Sheridan, Wyo. Testimony was given by 77 witnesses, including representatives of government, the oil and coal industries, and university and state research organizations. The geological, chemical, and engineering professions were well-represented by leading members of those professions who had given special attention to the subjects under consideration. The printed proceedings* of these hearings constitute a veritable mine of information on the national fuel reserves and various means of utilizing them for supplementing liquid fuels from petroleum.

### Organization of Work

Immediately following passage of Public Law 290 (authorizing the appropriation of not to exceed $30,000,000 during the next five years) in April, 1944, the Bureau of Mines prepared plans and estimates for carrying out the work authorized. Congress granted an initial appropriation of $5,000,000 for the fiscal year ending June 30, 1945, to be available until expended within the five-year limit.

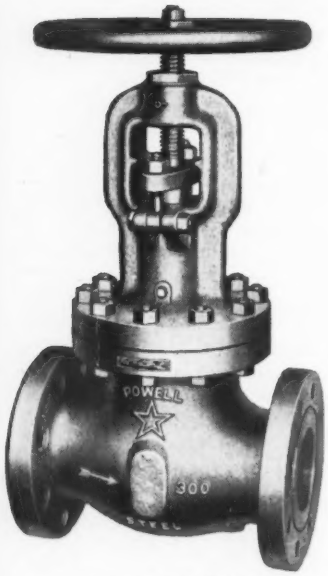
Conferences were held with representatives of the Department of Agri-

*This report was made before the Senate Petroleum Investigating Committee on June 22. Arno C. Fieldner, the author, is Chief, Fuels and Explosives Branch, U. S. Bureau of Mines, Washington.*

(*) Synthetic Liquid Fuels: Hearings before a subcommittee of the Committee on Public Lands and Surveys, U. S. Senate, 78th Congress, 1st Session, on S. 1243. U. S. Government Printing Office, Washington, 1943. 469 pp. Obtainable from the Superintendent of Documents, Washington, D. C. 75 cents.

# PURE NICKEL
# MONEL METAL* INCONEL* VALVES

## *The Solution to many a flow control problem*




Class 300-pound Cast Steel Gate Valve with Monel Metal trim.

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For twenty years, Powell Engineers and the Powell Special Alloy Valve Division have designed and fabricated valves in a wide variety of pure metals and special alloys to meet every flow control requirement of Modern Power, Chemical, Food Processing and Textile Plants, Oil Refineries, etc. This specialization is your assurance of satisfaction. Write NOW for details and your copy of our new booklet "Powell Valves for Corrosion Resistance."

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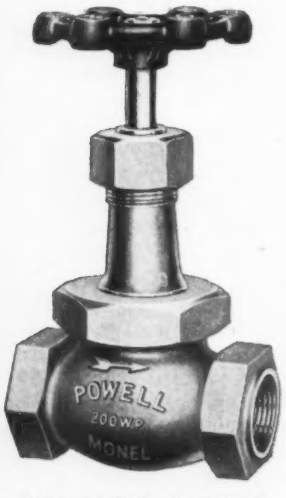


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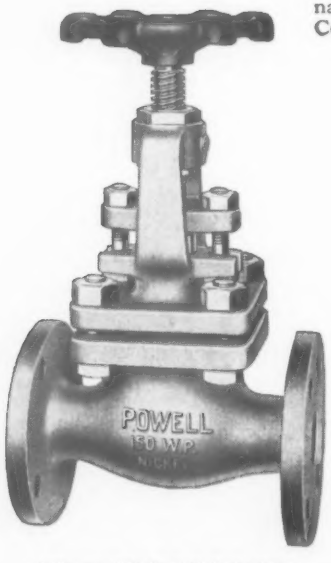
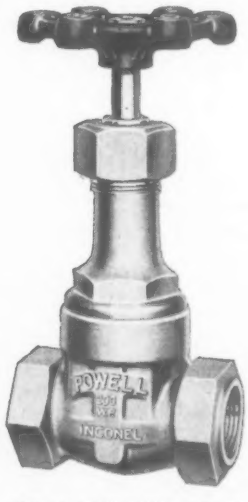
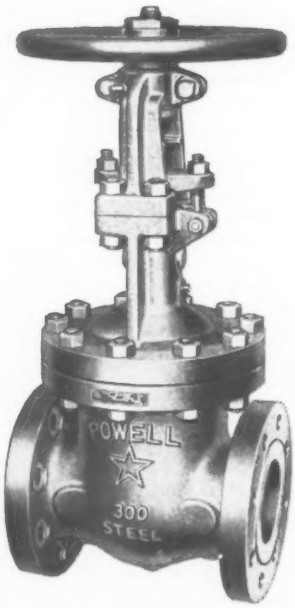



150-pound O. S. & Y. Gate Valve. Available in All Pure Nickel, All Monel Metal or All Inconel.




200-pound Gate Valve. Available in All Pure Nickel, All Monel Metal or All Inconel.




Class 300-pound Cast Steel Globe Valve with Monel Metal trim.

# POWELL VALVES

culture and arrangements were made with the Bureau of Agricultural and Industrial Chemistry of the Agricultural Research Administration for the erection and operation of a semi-works plant for the establishment of the technical feasibility and cost factors of a continuous process for the saccharification of agricultural residues to products from which alcohol liquid fuels can be produced by fermentation.

This pilot plant is being constructed at the Northern Regional Research Laboratory at Peoria, Ill. The Bureau of Mines will study the utilization of agricultural and forestry products for producing liquid fuels by the hydrogenation and gas synthesis processes in the same pilot and demonstration plants that will be used for coal and lignite as the processes are essentially the same for all of these materials.

Section 2. of Public Law 290 states, "In order to carry out the purpose of the Act, the Secretary of the Interior is authorized:-

(a) to conduct laboratory research and development work, and with pilot plants and semiworks plants to make careful process engineering studies along with structural engineering studies in order to ascertain lowest investment and operating costs, necessary to determine the best demonstration plant designs and conditions of operation".

This item is followed by other paragraphs referring to the construction and operation of demonstration plants.

To carry out the complete program, the Office of Synthetic Liquid Fuels has been established in the Fuels and Explosive Branch of the Bureau of Mines. It includes the following divisions:

(1) Oil Shale Retorting and Refining.
(2) Oil Shale Mining.
(3) Research and Development (Hydrogenation and Gas Synthesis).
(4) Synthesis Gas Production.
(5) Gas Synthesis Demonstration Plant.
(6) Hydrogenation Demonstration Plant.

The two Oil Shale Divisions will carry out both the research and demonstration plant projects on the mining and use of oil shale as a raw material for making oil and gasoline. The Research and Development Division will investigate the hydrogenation and gas synthesis processes. The Synthesis Gas Production Division will develop commerical methods for producing hydrogen gas for the hydrogenation process and carbon monoxide and hydrogen for the gas synthesis process. The Hydrogenation and Gas Synthesis Demonstration Plant Divisions are concerned with the construction and operation of the larger sized demonstration plants. The major staff personnel has been procured for the first four divisions, but not for the last two. The total number of employees now engaged on the program is approximately 160.

**Research and Development Division**

The necessary buildings for the development and pilot plant work on the hydrogenation and gas synthesis processes will be erected on the Bureau of Mines Experimental Coal Mine and Explosives Testing Station property at Bruceton, Pa. Six buildings, oil tanks, gas holders, coal bunkers, and other equipment will occupy a 12-acre on the 160-acre property.

The detailed design of the buildings has been completed and construction work started. The grading is completed and installation of foundations and new roads are under way.

Detailed design, specification, and purchase are under way for equipment to install two 1-barrel-a-day gas synthesis pilot plants, three experimental coal hydrogenation pilot plants of about 10 gal a day capacity, and laboratory-scale research apparatus for process development on both the coal hydrogenation and gas synthesis processes.

Larger pilot plants, possibly up to 10 b/d capacity, may be installed later if such larger pilot plants prove necessary for the design of the still larger (200 b/d) demonstration plants.

In order that no time should be lost while these new facilities were being designed and built, 5000 sq ft of additional laboratory and office space was obtained at the Central Experiment Station of the Bureau of Mines in Pittsburgh, by building a mezzanine floor in a building designed to house mine-rescue cars. With this additional space and with the securing of other temporarily available space it was possible to increase the research staff from 35 to 100 during the present fiscal year. The work of the Research and Development Division was allocated to eight sections having the following functions:

**Coal Hydrogenation Section**—To do research and development work on the conversion of coal by direct hydrogenation to automotive, Diesel, and heavy fuel oils; on the gas synthesis process at elevated pressures (above 600 psi) on the refining of products produced in coal hydrogenation and the gas synthesis pilot plants; and to operate synthesis gas and hydrogen production plants.

**Gas Synthesis Section**—To do research and development work on conversion of water-gas to automotive and Diesel fuels.

**Physical Chemistry Section**—To do laboratory research on the physical-chemical aspects of synthetic liquid fuel processes such as a study of the controlling factors in the rate of synthesis of hydrocarbons from water-gas; correlation of physical properties of catalysts (x-ray diffraction, magnetic properties, surface areas) with their activity in the synthesis of liquid fuels from water-gas. Analysis and identification of constituents of synthetic liquid fuels by physical (particularly optical) methods.

**Organic Chemistry Section**—To do laboratory research on organic-chemical aspects of synthetic liquid fuel processes; to separate synthetic liquid fuels into types of hydrocarbons by suitable means, and to identify constituents of the separate fractions by means of physical constants and by preparation of organic-chemical derivatives.

**Chemical Engineering and Design Section**—To prepare synthetic liquid fuel process and equipment designs from data obtained by the coal hydrogenation and gas synthesis sections for use in specification of new pilot plants or demonstration plants.

**Technical Reports Section**—To analyze data pertaining to synthetic liquid fuels published in technical and patent literature and to correlate such published information with the work of the Research and Development Division.

**Demonstration Plant Professional Personnel Training Section** — To serve as liaison group between Research and Development Division and demonstration plants.

**Service Section**—To provide safety inspection, equipment erection and rigging; instrument design, fabrication and repair; to make available services of machinists, pipe fitters, electricians, carpenter, painter, tinsmith, clerical help, storeroom keepers, steam engineers, firemen, telephone operators, guards, janitors, and messengers.

**Progress Made in Present Fiscal Year**

Despite the handicap of manpower shortages, especially in the professions of chemistry and chemical engineering, good progress was made during the present fiscal year.

Research and development work yielded the following results:

(1) Further development of a process for the production of a heavy Bunker "C" type fuel oil by hydrogenation of coal in the experimental plant operating 24 hours a day for extended periods of time. The objective is to determine the minimum amount of hydrogen necessary and the maximum throughput attainable.

(2) Additional data on the influence of vehicle-to-coal ratio and of catalyst concentration.

(3) More precise data on the composition of coal hydrogenation oils.

(4) Laboratory-scale development of a very efficient gas synthesis converter for which only about 10% of the steel required by the German converters is necessary. It will be tried on a barrel-per-day-scale at the Bruceton Laboratories.

(5) About 100 catalysts have been tested for activity during the past two years. For these tests a battery of 12 laboratory-size converters have been built and operated 24 hours a day for extended periods of time. Some catalysts

are kept on "on steam" for 3 to 8 months to measure the rate of deterioration in activity.

A number of physical characteristics; namely, x-ray diffraction patterns, surface areas, and magnetic properties of catalysts have been measured and correlated with the catalytic activity in the synthesis.

(6) An exhaustive survey of technical and patent literature on synthetic liquid fuel processes has been made.

(7) Preliminary specifications have been made for coal hydrogenation and gas synthesis demonstration plants.

**Program for Year Ending June 30, 1946**

On the gas synthesis process an extensive program of catalyst testing will be executed. This program involves a very large number of difficult analyses of gases and oils. The instruments necessary for such analyses have been purchased, and installation and training of personnel for their operation is under way.

The pilot plant development of the internally cooled gas synthesis converter will be carried into the 1-barrel-a-day stage. Laboratory-scale research will be done on the use of powdered catalysts suspended in the stream of the reactant gas mixture.

On the coal-hydrogenation process the development work on the production of heavy fuel oil will be completed, and experimental plant operation conducted to determine the influence of turbulence in the primary stage of coal liquefaction by hydrogenation.

Laboratory-scale research will be continued on the influence of the amount and kind of catalyst and vehicle used in coal hydrogenation, on the identification of constituents of coal hydrogenation oils, and on the isolation and study of the characteristics of typical chemical reactions occurring during the hydrogenation of coal.

Based on the results of our laboratory and pilot plant research and on information collected in Germany, preliminary designs will be made of demonstration plants for the coal hydrogenation and gas synthesis processes. It is also planned to train demonstration plant professional personnel in pilot plant operations so as to provide a nucleus of the personnel organization for those plants.

**Summary of Research Objectives**

The main objective of the research and development program is to provide new and improved procedures for use in demonstration plants for the coal hydrogenation and gas synthesis processes. It is obviously undesirable to erect costly demonstration plants to exhibit processes which have been operated for a decade or more on a large scale in Germany and other countries. An adequate period of time will be provided to develop improvements and radically redesigned processes, before the final design of the demonstration plants is selected.

Secondary objectives of the research and development program are the training of demonstration plant personnel, the accumulation of sufficient basic data to insure accurate engineering of the demonstration plants, and the production of up-to-date complete and detailed literature and patent reviews.

**Oil Shale Divisions**

The field activities of the oil shale divisions are divided between the Petroleum and Oil-Shale Experiment Station at Laramie, Wyo., and the Oil Shale Demonstration Plant at Rifle, Colo. Research and development work will be conducted in a new building now under construction on Bureau of Mines property at Laramie. A site has been selected for a demonstration plant to be constructed and operated at Rifle on Naval Oil Shale Reserve No. 1 to mine and process about 200 tons of oil shale a day.

Although many processes have been proposed for the recovery and refining of oil from oil shale, as revealed by nearly a thousand patents, in the U. S. none have been successful as commercial ventures and few have been found to operate with caking shales. Shale oil has long been considered a substitute for petroleum. However, special methods of extraction and refining must be devised through research to develop products that will be suitable for use along with those of petroleum. The main function of the research and development laboratory, therefore, will be to conduct several types of studies correlated to provide a thorough insight into the physical character and chemical composition of oil shales from different states and shale oil derived therefrom, and to determine the proper conditions for processing these materials and their products and by-products to yield marketable commodities as economically as possible.

The new building will not be completed before the end of 1945. In the meantime, a laboratory and office have been established in a temporary frame building on the land donated by the University of Wyoming for the location of the new laboratory building. Preliminary research work is well under way on the examination of shale oils produced in two experimental retorts which include a retort designed by V. F. Parry of the Bureau of Mines at Golden, Colorado, for the gasification of coal. The shale oil from the Parry retort was produced to provide the Navy with material for experimental purposes in their survey of sources of Diesel and boiler fuel oils. The Bureau expects shortly to receive a sample of shale oil produced some years ago from a horizontal type retort. This retort will be investigated as another type that might fit into the picture of the operation of the demonstration plant at Rifle.

Other research work under way includes the study of a small assay aluminum retort that apparently gives higher results in less time in comparison with the type of retort now being used in routine oil shale assays for oil content. The design of suitable equipment for the determination of engineering data such as oil shale specific heats, heat conductivity, and the rate of shale oil formation in the shale are progressing with an occasional detour caused by a lack of materials and precision instruments usually available in time of peace.

The accumulation of this research information is the basis for a scientific design of an oil-shale extraction process and the establishment of a standard of operating efficiency. As the program progresses, the Bureau of Mines expects to develop from small-scale experiments, where conditions can be controlled and altered rapidly, the best methods for extracting oil from shale to yield the largest quantity of high quality product. The results of this work will serve as a guide to selecting the most satisfactory means of shale oil extraction to be incorporated in the demonstration plant.

Petroleum is obtained as an organic liquid from holes drilled through the earth's surface to saturated oil-bearing sands. Oil shale contains organic matter, but it is solid and the only means found so far for converting this solid material to a liquid is some form of heat. One of the research projects to be ultimately investigated is a method for heating oil shale underground to drive out the oil. It is obvious that many difficult problems are involved in such a procedure; for example, regulating the degree of heat, the area to be heated, and providing the necessary means for collecting and draining oil from residual rock.

Plans have been made by a group of Bureau mining engineers for mining oil shale of various characteristics at a demonstration plant mine site with the main function being the development of methods and equipment for large scale mining and to determine the cost. Offhand, it would seem that methods developed for coal and other minerals would be applicable to oil shale, but oil shale is not an ordinary mineral. It is tough and, to a certain extent, elastic. The economical block caving method of the coal industry is not applicable because oil shale will not cave. A flat ceiling over a room about 90 ft in diameter has stood for many years with little spalling in the Bureau of Mines experimental mine at Cottonwood Point, Colo.

The toughness of oil shale becomes most apparent in the crushing to suitable sizes for handling and processing. Therefore, an investigation on the mining of oil shale is an important part of the research and development program and will comprise a broad study of methods, equipment, and costs for large scale mining of oil shales of various characteristics under a wide variety of conditions. This work will include the collection and analysis of data from commercial mines of various types, as well as from the mine at the oil shale plant.

Oil shales of various characteristics occur in quantities of possible com-

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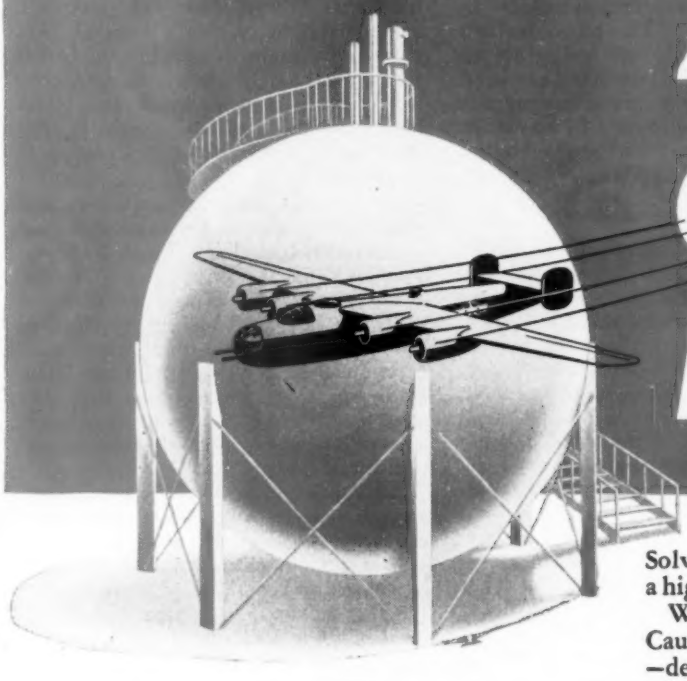

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R-713

mercial importance in eight states and in smaller quantities in at least 13 other states. The major deposits occur in the Green River formation of the western states and the New Albany formation of the eastern states. The Green River formation contains the Tertiary shales of Colorado, Utah, and Wyoming. The New Albany formation contains the Devonian shales of Indiana, Kentucky, and Ohio. Isolated deposits of probable importance are found in formations of other ages in Nevada and Texas. Information concerning the oil shale deposits in these eight states were collected during a survey for the selection of a general area for the location of an oil shale demonstration mine and plant.

Items in the survey included information on the location of oil shale deposits, their richness and estimated reserve, general topography of the area, availability of power, water, transportation and living conditions. After an initial survey, ten field trips were made to verify earlier information. A comparison of the regional data indicated that the area between Rifle and DeBeque, Colo., north of the Colorado River, was superior to any other area for the location of an oil shale demonstration mine and plant. Shales of adequate richness and variation in characteristics for mining research and demonstration were found to be available in a single section. Each of the other oil shale areas was found to be unsatisfactory from at least one standpoint. Certain areas in Utah, remote from transportation and living accommodations, are the only locations that offer shales equivalent in richness and variation in characteristics to those in the Rifle-DeBeque area.

In August, 1944, Bureau of Mines engineers started a survey that was completed six months later with the recommendation that the oil shale demonstration project to include mine, plant and camp sites, be placed on Naval Oil Shale Reserves Nos. 1 and 3, in the Anvil Points area about 7 miles west of Rifle, Colo. Secretary Ickes approved this recommendation on Feb. 17, 1945.

The initial step in the survey was preliminary reconnaissance of the Green River formation in Northwestern Colorado. Out of 19 possible sites, three sites in the Rifle-Grand Valley segment of the Colorado River Valley were subjected to concentrated reconnaissance surveys when it became apparent that water could be supplied to most of the other 16 sites only by an expensive installation.

The three sites were designated as the Anvil Points, Cottonwood Point and Allen Point areas. A topographic survey was made of each site and the maps studied to determine where the mine, tramway, plant and camp could best be fitted to the rugged terrain. A systematic sampling procedure was instituted to establish an assay log for each of the three sites and 129 samples were taken and sent to the Laramie Station where they were assayed for the necessary information.

Progress since the approval of the oil shale demonstration plant site has been steady although perhaps not too rapid at times. The housing situation has been very critical, limiting the personnel that can be employed. This situation will be relived when the camp is built, but construction of the camp cannot start until suitable arrangements have been made for a water supply, and pumps of sufficient capacity to lift water from the river bed to the camp site are being promised for delivery six months after receipt of the order.

In other respects, progress has been much better. Preparatory work on the mine was started after pulling a portable compressor up the cliff to the mine site. Wage board rates have been established. A design of the first retort is being revised after critical review by Bureau engineers. The office building has been designed and invitations for bids on construction are being prepared. A contract for power from a line supplied from a Government-owned hydro-electric plant has been prepared and submitted for approval.

### Demonstration Plants

To enable the Government to furnish industry with the necessary cost and engineering data for the development of a synthetic liquid fuels industry, demonstration plants are to be built for the coal hydrogenation and gas synthesis processes. New equipment and methods devised in the research and development program can thus be tested on a larger scale and their feasibility and costs determined. Each of these plants will produce about 200 b/d of oil as compared to pilot plant yields of 1 to 2 barrels.

The location of these demonstration plants has not yet been determined but Bureau engineers have been conducting an investigation to obtain data on the best location. More than 160 communities in 22 coal-producing states have proposed 205 sites as possible places for the hydrogenation and gas synthesis demonstration plants. Representatives of the Bureau of Mines have inspected 170 of the 205 proposed sites. The information obtained on each site is being tabulated for comparison and the salient features will be reviewed carefully for the purpose of reaching a decision.

The following governing factors are being considered in connection with choosing suitable sites: site and its immediate surroundings, transportation of coal, water supply, power, contiguity to coals suitable for conversion to liquid fuels, accessibility to various banks and types of coal, accessibilities to source of equipment and services, accessibility to visitors, and living conditions for personnel.

The evaluation of the sites is being made on the basis of having both the hydrogenation and the gas-synthesis plants on the same site with facilities adequate for both. This would eliminate duplication of offices, laboratories, boiler and power plants, including auxiliaries, water system, and sewage disposal, machine shop and repair facilities, railroad spurs, coal handling and storage facilities, roads and parking lots and cafeterias, resulting in a considerable saving in initial investment. Operating costs as well as the number of men needed to run the plants would also be reduced, since supervisors, power plant operators, watchmen, mechanics, office workers and clerks could be used to provide service for both plants without material increase over the number of employees needed for these duties in a single plant.

The hydrogenation demonstration plant will consist of two series of converters. The first 9 converters will be 32 in. inside diameter and 35 ft long. These cylinders will be lined with heat-insulated material and will contain a metal basket in which the reaction takes place. The inside diameter of the basket will be 24 in. Baskets and converters will be made of high-chrome steel. This equipment and all its auxiliaries will be designed to operate at pressures up to about 10,000 psi.

The second series of converters will consist of 3 units of the same size used at Billingham, England, that is, 59 in. inside diameter and 35 ft long. The insulation and basket reduce the diameter of the space available for reaction to 48 in. Results from these three converters can be compared with the 30-in. converters to eliminate errors that may arise from extrapolation to the larger size and to assure accurate data on capacity and costs.

All auxiliaries for the plant will have enough capacity to handle the full-sized converters, and will be designed for 10,000 psi; that is, they can be used to operate either string of converters.

This plant will hydrogenate about 65 tons of bituminous coal and produce almost 8,400 gal. (200 bbl) of gasoline a day. An additional 65 tons of coal per day will be used to produce the hydrogen, steam, and power required. A refinery is included in the estimate, but it is essentially only a simple distillation step (distillation will reduce sulfur below 0.01%) for the gasoline leaves the vapor phase converters at almost 84 octane and by treatment with tetraethyl lead and cumene or isooctane can be brought directly to 100 octane.

The gas synthesis demonstration plant will have 14 converters and will produce about 200 bbls of primary products (gasoline, oils, and waxes) per day. The plant consists of 3 units. The first for the production of synthesis gas will contain the raw material handling equipment, gas generators, purification equipment, and compressors. The second unit, for the production of the primary products, will contain the gas storage equipment, converters, primary-product recovery system, cooling equipment, and all equipment needed for the prepara-

tion and reduction of the catalyst. The third unit will contain the equipment for the separation of the primary product into gasoline, oil, and wax. This will consist of cracking, distillation, and auxiliary refining equipment.

These are tentative designs which, no doubt, will be modified as the pilot plant work at Bruceton proceeds, and as information from the oil mission to Germany becomes available to the Bureau of Mines.

The cost of these demonstration plants may exceeed the limits set by Public Act 290. For this reason serious consideration is being given to the possibility of securing one of the surplus synthetic ammonia plants that may become available after the close of the war. These plants contain much of the equipment required for the production, purification, and storage of hydrogen and synthesis gas. To a considerable extent, the buildings, especially the offices, laboratories, shops, power and steam plant, coal handling equipment and other facilities would be directly usable in a synthetic liquid fuel demonstration plant. Several of these Government-owned ammonia plants have been examined by Bureau Engineers and at least two of them are well-adapted for the purpose and are suitably situated with respect to important coal fields.

### Foreign Oil Mission

The greatest development of synthetic liquid fuels processes has been made by the Germans. Some information has been available on the processes used by Germany. For example, it is reported that the Diesel oils produced synthetically in Germany were superior to those produced from petroleum. But details of new developments in Germany since the war began, which enabled Germany to reach an annual production estimated at 50,000,000 bbl of synthetic oil and gasoline from coal, were not known outside of occupied territory. Our victories in Europe have provided an opportunity to visit the famous German synthetic oil plants. Engineers from the Bureau of Mines Office of Synthetic Liquid Fuels are now in Europe studying the remains of the German plants, collecting records, interviewing operating personnel, and sending back samples for examination in our laboratories.

To the extent that German processes are applicable to American coal, lignite, or shale, the information will be used to speed up the Bureau of Mines program. Even though the nature of German brown coals is somewhat different from that of American lignite and subbituminous coal, their experience and technique will aid in developing suitable processes for our low-rank coals.

**Grateful acknowledgement is made of the following members of the Office of Synthetic Liquid Fuels for their assistance in preparing this statement: Dr. H. H. Storch, Chief, Research and Development Division; A. J. Kraemer, Chief, Oil Shale Division; J. D. Doherty, Assistant Chief, Office of Synthetic Liquid Fuels.**




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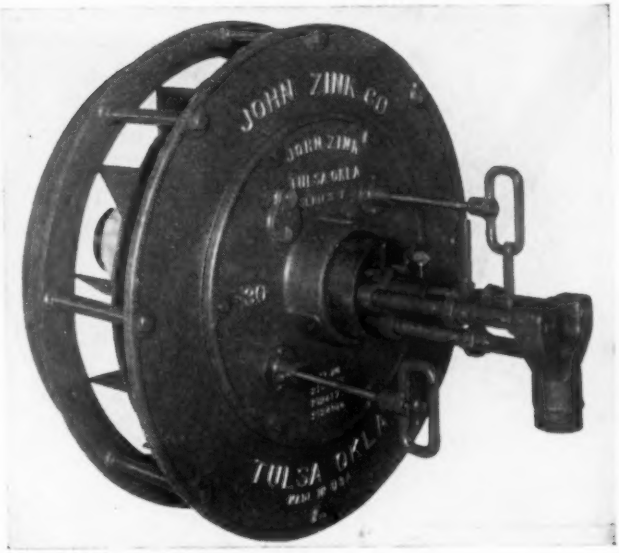


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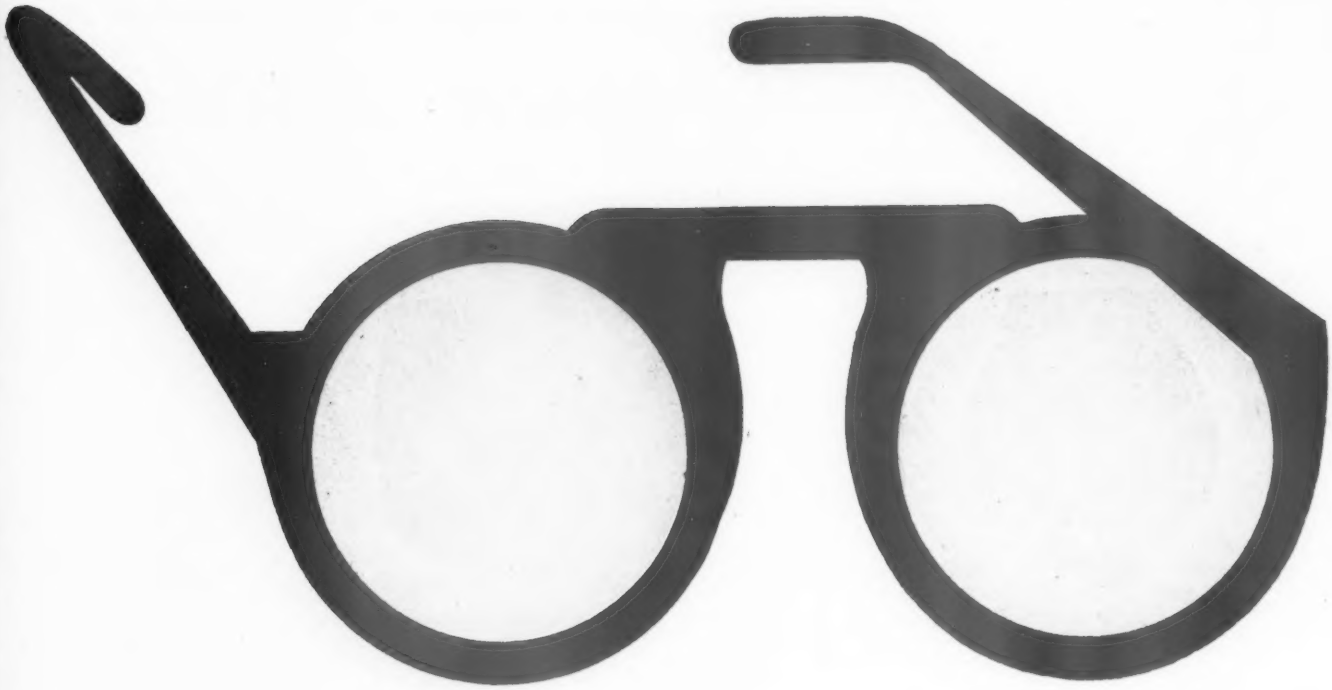

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R-717

# Bearing Development Up to Date

*By Henry W. Luetkemeyer*

OUR TITLE suggests that we should start with an elaborate history of bearing development, perhaps beginning with a stone age man with his wooden wheel and wooden axle, and carrying on through the use of the greased hide bearings of a later date; the bronzes and irons of the Phoenicians, the sintered powdered metals of the Incas; and the oak and bacon rind of the early settlers of this country.

To the best of our knowledge, Isaac Babbitt is responsible for bearings as we know them today. Babbitt's patent of 1839 was the foundation upon which the metals that were named for him were developed, and there has not been too much change from his original patent even to this day.

From Babbitt's time on there have been tremendous strides in mechanical knowledge which have necessitated changes of considerable importance in bearing requirements. Along with mechanical improvements came the metallurgist and the chemist, who made possible the full use of our mechanical knowledge, and today we find ourselves no longer hampered by lack of materials to complete our designs. Design has now become a matter of compromise between the ultimate of our theoretical knowledge and good economic practice.

As our experience increases — and it has increased tremendously during the war years — we find that as yet no ideal bearing material has been found, nor do we expect to find one.

Constantly increasing demands for life and output of automotive equipment have placed bearings in a critical position from time to time; however, today we feel that we of the bearing industry have materials which are satisfactory up to the film strength of oil, provided other conditions are not excessive.

In general, bearing life is characterized by three qualities:

**1)—Resistance to fatigue.**

**2)—Surface action.**

**3)—Corrosion or wear.**

You will note that we have placed fatigue first. This has been done because, in the main, the design of a machine determines what this requirement will be. With respect to fatigue, we have today the extremes of babbitt on one hand and electroplated silver on the other. Each of these extremes, and the many materials between, offer their good and bad features.

The second quality, surface action, is inherent in the material selected under the heading of fatigue. These surface actions are affected by hardness, machinability, weldability, imbeddability and wettability. We believe these terms to be self-explanatory, except for the last two. Imbeddability refers to the ability of the material to receive into itself foreign material in such fashion that the particle will not disrupt normal contact area or the oil film; and wettability refers to the ability of the lubricant to cling to the surface.

The third characteristic, corrosion or wear, is generally a combination of chemical and mechanical removal of the bearing surface, but either phenomenon may occur separately. We believe, however, that much erosion has been mistaken for corrosion.

Failures, or near failures, attributable to these three bearing qualities may be emphasized by the illustrations in Fig. 1.

Keeping these three qualities — fatigue, surface action and corrosion or wear, in mind, and considering the service requirements of bearings as we know them today, we may roughly classify different types of service in terms of hours of life:

| | |
|---|---|
| Aircraft Engines | 1,000 Hours |
| Passenger Cars | 2,000 Hours |
| Trucks | 4,000 Hours |
| Marine & Rail | 5,000 Hours |
| Stationary | 15,000 Hours |

As we compare these applications, we find that bearing life is a function of unit pressure and, in general, loads must go down as time goes up. Also, we find that engines which are required to operate at peak loads a small percentage of the time may be designed for high loads, whereas those designed to operate at near full loads continuously must of necessity have more conservatively loaded bearings.

### Bearing Materials

Proper selection of materials for a particular application depends on the required bearing life in hours. Shaft physicals and lubrication must also be considered and may be the cause of some compromise. In the following paragraphs we show the major advantages of various bearing materials.

The "white" metal alloys, both tin and lead-base, offer the best surface action between bearing and journal, permitting extremely soft shafts. However, their fatigue resistance leaves something to be desired. Their reaction to corrosive conditions is excellent for all of the tin-base materials and generally good with such lead-base materials as SAE No. 14 and SAE No. 15.

The cadmium base alloys have received some recognition because their fatigue resistance has been sufficiently better than tin and lead-base alloys to give satisfactory operation in applications which were border-line for the other "white" metals. However, corrosive conditions offer difficulties. The limited availability of cadmium has, for the present, removed these bearing alloys from the market. It seems probable that when they are again available the improved techniques of handling other materials—notably some of the lead-base materials —will further restrict the need for these cadmium-base alloys.

The copper-lead alloys offer us good fatigue resistance but have considerable sensitivity to corrosion and do not have the desirable surface action of the "white" metals, often showing increased journal wear.

Aluminum, which has been used with some degree of success since the work by Rolls Royce about 1935, offers possibilities of success with the improvements quite recently made in this country. This material has shown virtually no corrosion tendencies and has good fatigue resistance, as indicated by numerous laboratory tests. Data from the field tend to confirm this where conditions are satisfactory. Hard journals, large running clearances, large quantities of cool oil sufficient to hold bearing temperatures below 275° F., and a high degree of protection against dirt or other foreign material seem, at the moment, to be prerequisites. Considerable work remains to be done to establish whether the limits of these conditions will be within the practical range for a great number of bearing buyers. Another practical consideration is the lack of a definite elastic limit, which, although not undesirable in a bearing material, offers some problems with respect to maintenance of sufficient crush. Added to this, difficulties in holding the bearing tightly under all temperature conditions must be considered due to the greater thermal expansion of aluminum as compared with cast iron or steel. These problems, applying to the solid aluminum alloy bearing, could no doubt be overcome to a great extent should a suitable bonding technique for applying these alloys to steel be developed, or should the alloys be modified sufficiently.

Silver as a bearing material has much romance for the uninitiated. It does have excellent fatigue resistance, excellent corrosion and wear resistance, but leaves much to be desired as to its surface action. This surface action has been partially circumvented by the addition of a surface layer of lead which is indium treated for corrosion resistance. However, with but .001 in. lead and indium, machining, distortion of all kinds, crankpin finish and hardness must all be controlled with great care, or at least completely understood, with proper allowances made. This bearing, although it lacks the ability to deform sufficiently to

*This paper was presented at the meeting of the Cleveland Section of the Society of Automotive Engineers, May 17, 1945. The author, Henry W. Luetkemeyer, is Chief Experimental Engineer with the Cleveland Graphite Bronze Co.*

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correct mechanical interference, has had marked success. Without it our present day war planes could not have their high performance engines. This construction is not too dissimilar from the earlier trimetal construction composed of steel, an intermediate layer of leaded bronze and a surface layer of tin-base alloy.

Echtels & Underwood have recently printed a paper which discusses silver thoroughly and includes information on grid or indented instruction.

Powdered metals are definitely beginning to invade the internal combustion field in both rod and main bearings. The original advantages claimed for the powdered metal bearings lay in their porosity, permitting storage of oil in the bearing to be readily available to the working surfaces. The volume of oil thus stored has proved totally inadequate for connecting rods or main bearings. It has also been found that the usual powdered metal bearing mixture lacked fatigue strength. These experiences have led to the use of stronger mixtures of powdered metals as an intermediate layer between steel and a working surface of some soft, cast, or plated bearing material. Thus, a tri-metallic type of bearing is formed which has many of the characteristics of the tri-metallic bearings using cast or plated intermediate layers.

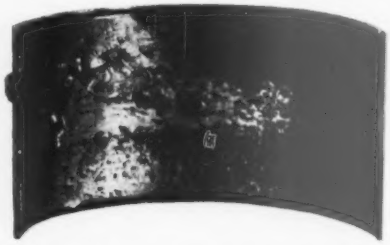
Trimetal, as previously described, and Micro bearings, composed of a thin layer of "white" metal bonded directly to a steel back, were originally conceived as a result of laboratory tests which indicated that if the surface layer were thin enough, marked improvement of fatigue properties could be obtained. This data has been well substantiated in the field, and today we find both constructions used, the trimetal having considerable advantage owing to its bearing-like intermediate layer which offers a safety factor which cannot be ignored.

Two rather practical difficulties have resulted from the trimetal construction. First, in manufacturing bearings of this type, considerable expense occurs in maintaining the babbitt layer within the thickness range of high performance; and second, in bonding tin-base babbitt on copper-lead, we have found that difficulty develops unless the copper is "satisfied" with at least 7% of tin. This, of course, makes the intermediate layer relatively hard and its ability to absorb foreign material and to adjust itself to the irregularities of the journal, as well as other surface action, are not wholly desirable.

Recognizing the problems of the trimetal construction and the potential advantages of copper-lead instead of leaded bronze intermediate layers, we were interested in the possibilities of precision plated layers. However, it was not until the war that it became a demonstrated fact that a thin surface layer can be plated on a bearing without subsequent machining and also that such a layer—even as thin as .001 in., would last a surprisingly long time and sustain very high loads.

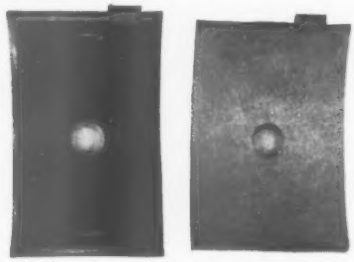
Our Clevite 77 is such a bearing and is composed of the usual steel back with all of its fine qualities; next an intermediate

*Fig. 1—Reactions of Bearings to Various Conditions*



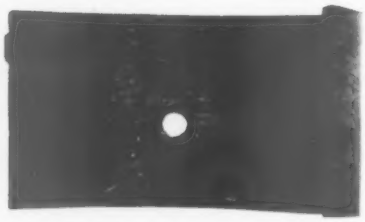
**FATIGUE—extreme dirt; evidence of melting due to heat**

**IMBEDDABILITY—dirt not properly handled, in contrast with following picture, below**

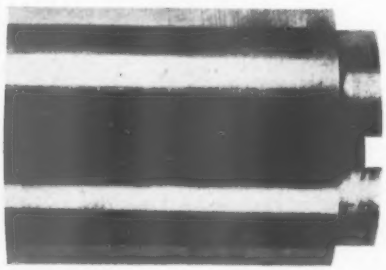


**CORROSION—bearing on left is new, one on right illustrates a normal case of pure corrosion**

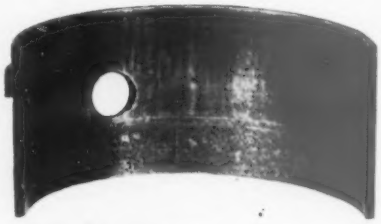
**FATIGUE—excessive dirt. Shows imbeddability. In center of bearing, dirt could not emerge from oil hole with oil. Considerable dirt has been handled**



**IMBEDDABILITY—Clevite 77 has successfully handled large amount of foreign material**

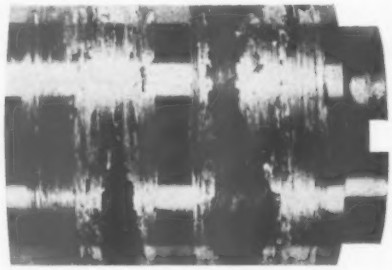


**WELDABILITY—two bearings act on sleeve; left seized, no welding or scoring**



**IMBEDDABILITY—loads not excessive, dirt handled without failure**

**EROSION plus CORROSION—note diagonal removal of material as indicated by dark areas**



**WELDABILITY—both bearings have seized; no scoring evident due to hardness, weldability evident**

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**Fig. 2—These drawings illustrate extremes in bearing grooving, but they emphasize the loss of area**

layer consisting of 75% copper, 24½% lead and ¼% tin, which is a true bearing material of good bearing qualities except on shafts below 230 Brinell; and then a plated surface layer of lead, tin and small amounts of hardener. This surface has been studied in comparison with lead-indium under many conditions and appears to have no disadvantages.

Cast iron has become a material in the bearing field as a result of a recent development in the art of bonding called the "Kolene Process," which has made possible the use of cast iron as a backing layer for tin and lead-base bearings. At the moment, this creates a new source of backing material at a time when tubing and forgings are not readily available. After two years of production experience with the Kolene Process, it is evident that it will make possible considerable economies in bearing manufacture. Cost of castings versus steel forgings or tubing and machinability of cast iron as compared with steel need not be discussed here, but engineers who are cost-conscious should consider the possibilities that this process offers, particularly in the Diesel field where volume, in the passenger car sense, is relatively small.

### Bearing Loads

Our present experience suggests the following generalized load-carrying capacities of the materials which we have discussed. These loads are the maximum loads in pounds per square inch based on projected area. We have divided all applications into several general classifications, intending to indicate the types of service by the names of the classes. For example, the Diesel group includes stationary engines, marine engines, and others where long life is a first consideration and where output per pound of engine is not a major design problem. Truck and bus applications, although many of these actually are Diesel engines, have been classified by themselves. In addition, these tables are based on an assumption of proper grooving, clearances, lubrication and accurate machining.

The list of chemical analyses of various bearing alloys (Table 1) indicates those used by our company. These are given here to clarify the several trade names referred to in the list of loadings which follow:

| | In Pounds per Square Inch | |
|---|---|---|
| | Was | Is |
| **PASSENGER CARS** | | |
| D-2 and Lead Base | 1500 | 1200 |
| Micro | 1800 | 1400 |
| Clevite 35 | 2000 | 1600 |
| Clevite 77 | .... | 3000 |
| **AUXILIARY DRIVES** (This includes generators, superchargers and small high speed auxiliary engines.) | | |
| D-2 and Lead-Base Trimetal D-2 } Up to 15,000 Ft./Min. | 200 | 500 |
| F-77—Up to 2,000 Ft./Min. | .... | 2500 |
| **TRUCKS and BUSSES** | | |
| D-2 and Lead-Base—Micro | 1500 | 1200 |
| Clevite 35 | 2000 | 1500 |
| Trimetal | 2000 | 1800 |
| Clevite 77 | .... | 2500 |
| **DIESEL** | | |
| D-2 and F-23 | 1200 | 1000 |
| Clevite 35 | 1800 | .... |
| F-14 | .... | 1800 |
| Trimetal | 1800 | 1800 |
| Clevite 77 | .... | 2500 |
| **AIRCRAFT** | | |
| F-14 | | 3500 |
| Silver and Lead-Indium | | 5000 |

You will note that we have, in general, modified our recommendations downward for any particular material. This is due to a change in field conditions. For example, trucks and busses, due to better roads, more favorable grades, much improved braking, reduced operator fatigue, better roadability and better cooling systems are being run for greater periods of time at maximum rated bearing loads.

The same sort of change in percent of total time at maximum conditions is in evidence in nearly all branches of the industry. Good examples are the effect on passenger cars of the Pennsylvania Turnpike and similar highways where speeds can be maintained for considerable periods, also on aircraft engines developing several times the horsepower per cubic inch of a few years ago, and small high-speed Diesel engines being used on long ocean voyages. These may be war emergencies now, but experience indicates that operators will not go back to the conservative demands of pre-war days. Consequently, we feel that a modification in recommendations is desirable.

### Oil Grooving

Previous mention has been made with respect to grooving. Considerable benefit has been derived from the problems solved in the aircraft industry where bearing pressures are frequently extreme. It has been found that the geometric pattern of the groove is of secondary importance compared with its cross-sectional form. If one thought is borne in mind, grooving becomes simplified, i.e., sharp corners will prevent flow. An example of this is the piston ring. We have known for many years that width of ring was secondary to sharp corners. The reverse situation is desirable with respect to the grooves and holes of bearings. Elaborate grooves are definitely out-of-date and have been replaced by simple forms which maintain a maximum bearing area.

The few examples shown in Figs. 2, 3 and 4 indicate what is desirable.

From these illustrations it is evident that we must help the oil to form the all-important wedge which will lift the journal from the bearing. No amount of refining or "doping" will put the oil where it is needed.

Too many applications today have been stepped up in performance to a boundary-line condition. Many of these can be considerably improved by attention to detail.

### Oils and Fuels

This paper would not be complete without some mention of oil. At the present time there is a scarcity of suitable lubricants because of the immense military demand; therefore, today we find ourselves in the precarious position of expecting our products to perform satisfactorily with oils that range from poorly refined, carelessly blended cheap oils, made from inferior crudes, to the quality

**TABLE I—Nominal Chemical Analyses of Bearing Materials**

| Name and Description | Specification No. C.G.B.* | S.A.E. | A.M.S. | Analysis Cu. | Sn. | Pb. | Sb. | Others |
|---|---|---|---|---|---|---|---|---|
| Tin-Base Babbitt, D-2 | F- 1 | 110 | .... | 3¼ | 89¼ | .... | 7½ | .... |
| Cadmium Nickel | F- [illegible] | 18 | .... | .... | .... | .... | .... | 1¼ Ni, 98¾ Cad. |
| Lead-Base Babbitt, F-23 | F-23 | 15 | .... | .... | 1 | 83 | 15 | 1 Arsenic |
| Clevite 35—Copper-Lead | F-12 | 480 | .... | 65 | .... | 35 | .... | .... |
| Clevite 77—Copper-Lead | F-77 | .... | .... | 75 | ¼ | 24¼ | .... | .... |
| Copper-Lead | F-14 | 48 | 4820 | 70½ | .... | 28½ | .... | 1¼ Silver |
| Leaded-Bronze | F-19 | .... | 4827 | 80 | 10 | 10 | .... | .... |

* Cleveland Graphite Bronze.

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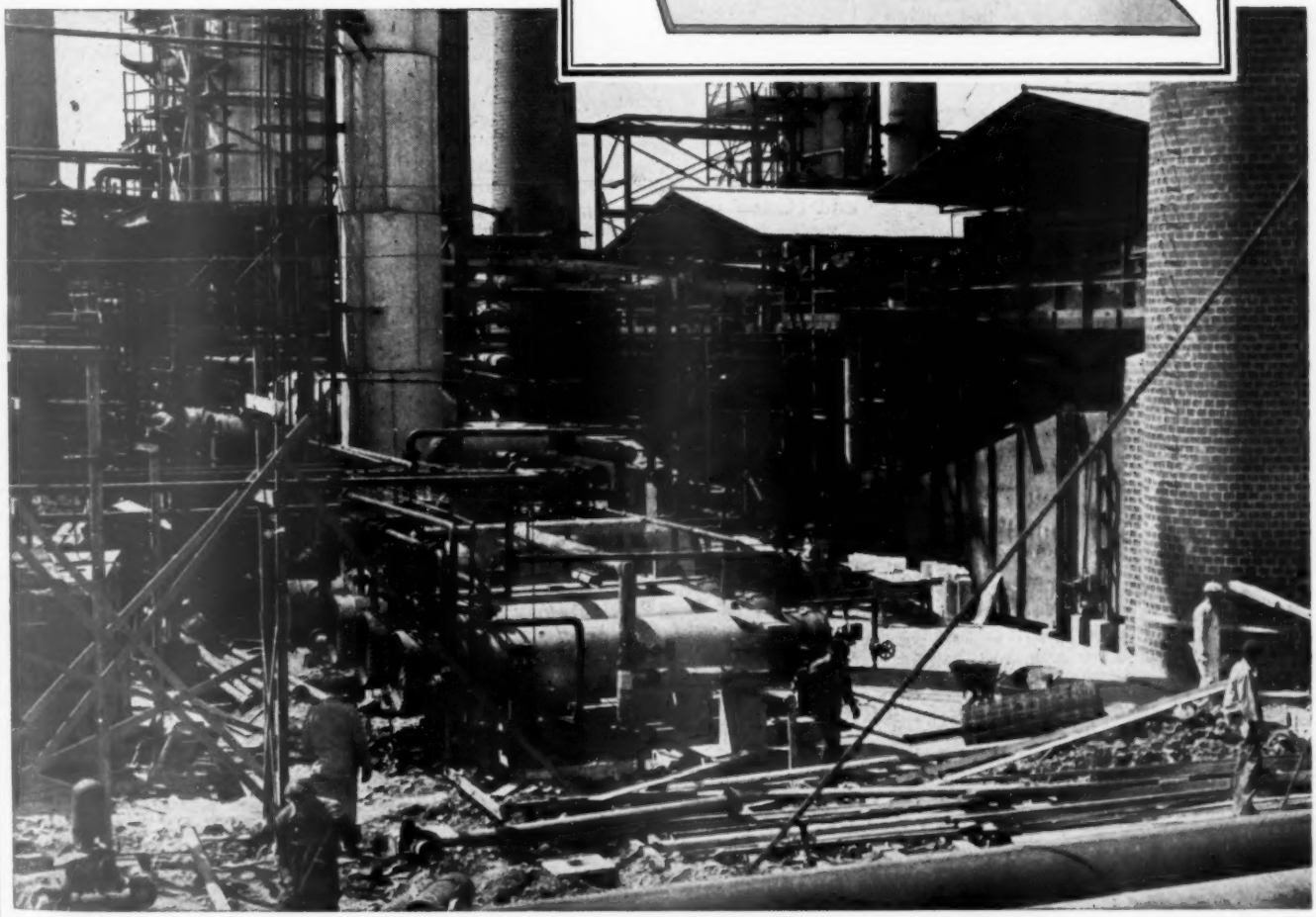

oils carefully made, properly blended and suitably fortified with addition agents.

We are not alone with this problem and as long as an owner of a piece of automotive equipment feels free to use almost anything that is sold as oil, automotive equipment will be subject to premature failure. Certainly fleet and individual operators should be made to understand the wisdom of buying from reputable sources and following instructions regarding drain periods, flushing and sludge removal.

This problem may rightly belong in the oil manufacturers' hands, and we are happy to report that they are, in general, making good progress in this direction. Perhaps greater firmness by manufacturers of engines would speed this progress. In fairness it must be stated that many oils are being improved, and we find sufficient evidence to indicate that a definite trend toward simplification of bearing problems and those of other engine parts can be anticipated.

The amount of oil required for proper lubrication is debatable. Our experience leads us to feel that sufficient cooling and a well-filled clearance space are the important considerations, and that when these are fulfilled the bearing is, of necessity, well lubricatel. The use of 30 gallons per minute per square inch of total bearing clearance is an old rule which is still satisfactory for the majority of internal combustion engines; however, we expect to modify this rule in the not too distant future.

Fuels are probably greater offenders today than lubricants. Changes in refining processes to increase output of aircraft fuels, plus the great demands of war vehicles, have caused civilian fuels to be considerably changed. Blow-by products and dilution, plus slow driving of passenger cars, are causing many bearing failures.

### Testing Technique

The study of fatigue resistance in the laboratory is now well understood and quite well coordinated with field conditions, making it possible to anticipate fatigue life of new materials in the field. However, the laboratory data with respect to surface action and corrosion resistance leave much to be desired when compared with field performance.

To a great extent this difficulty lies in the fact that causes for fatigue are generally fairly constant in any given design, regardless of its geographic location and attendant conditions. With surface action, corrosion and wear we find that this is not true. Variables in temperature, types of dirt, lubricants which are available, as well as many other factors, are frequently unpredictable; consequently, it has been necessary to separate the various contributing difficulties and attack them one at a time.

Over a period of years, a number of corrosion tests have been developed which have been sometimes helpful and sometimes misleading. At the present time, the Chevrolet oil test is giving very constructive help and it is to be hoped that in the not too distant future we shall better understand this problem. Wear, in the sense of mechanical removal of material, i.e., other than erosion, offers no problem so long as dirt is not present in the lubricating oil. Wear rates, such as measured on the end of hollow cylinders or small circular areas using kerosene for lubricant or no lubricant at all, have been determined. However, these are too far removed from practice to help in bearing wear determinations. Erosion is apparent in many bearing applications and at the present time seems to result from improper grooving which concentrates oil flow over too small areas, or from mechanically weak bearing surfaces.

Surface action, in the sense used in this paper, has been studied in various ways. This has usually been done by abstract means which have been faulty in much the same fashion as the abstract wear and corrosion tests. At present we are studying surface action, using a modified Underwood Bearing Testing machine. We have found that this machine is quite satisfactory for this purpose as well as for fatigue testing.

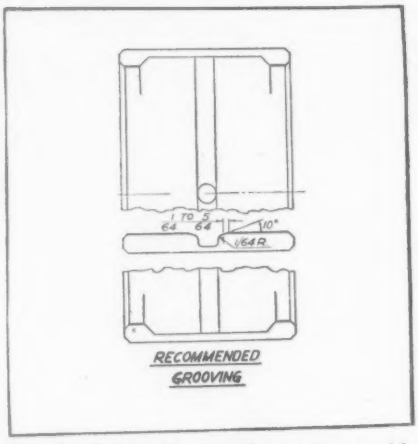


**Fig. 3—A simple annular groove with properly contoured edges ending in well-blended spreader grooves maintains maximum bearing area throughout loaded zone and properly supplies oil**

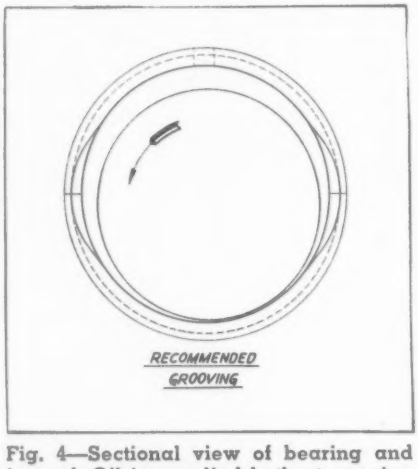


**Fig. 4—Sectional view of bearing and journal. Oil is supplied both at opening and closing wedges, permitting proper supply to entering wedge to hold journal away from bearing and also ample supply to closing side to prevent cavitation**

### Design Information

Certain basic design data have been well proved and may be touched on lightly here. L over D ratios of 1 over 2 to 1 over 4, when practical, simplify the problem of obtaining uniform loading across the bearing.

Precision methods of manufacture have made the old metal-to-metal fits unnecessary and if *clearances* are held to a minimum of .0005 in. per inch of journal diameter for the "white" metals and .0075 for copper-leads, they will be found satisfactory in most cases. Dimensional tolerances of journal, bearing and rod bore must be closely held or an excessive maximum clearance will result.

Crush or parting line height of bearings is a much discussed problem. Its purpose, of course, is to produce a press fit to hold the bearing to its proper shape and in its proper location. The actual requirements vary considerably with the application, size, finish, tolerances and materials being the important considerations, and no general rule can be offered here.

Aluminum cases are causing some bearing problems today, particularly where engine noise must be kept to a minimum and easy starting at 10 or 20° below zero is desired. Some caution must be used in balancing case, bolt and bearing sizes so that sufficient restraint of temperature effects is obtained.

One additional caution must be expressed in concluding. The automotive industry is preparing for one of its cyclical redesigns of engines. It may be assumed that these redesigns will include the use of many new materials permitting materially higher outputs.

This is as it should be, but with respect to bearings we feel that it will be quite insufficient to use new materials without carefully studying manufacturing practices to assure that attendant parts are properly made in production.

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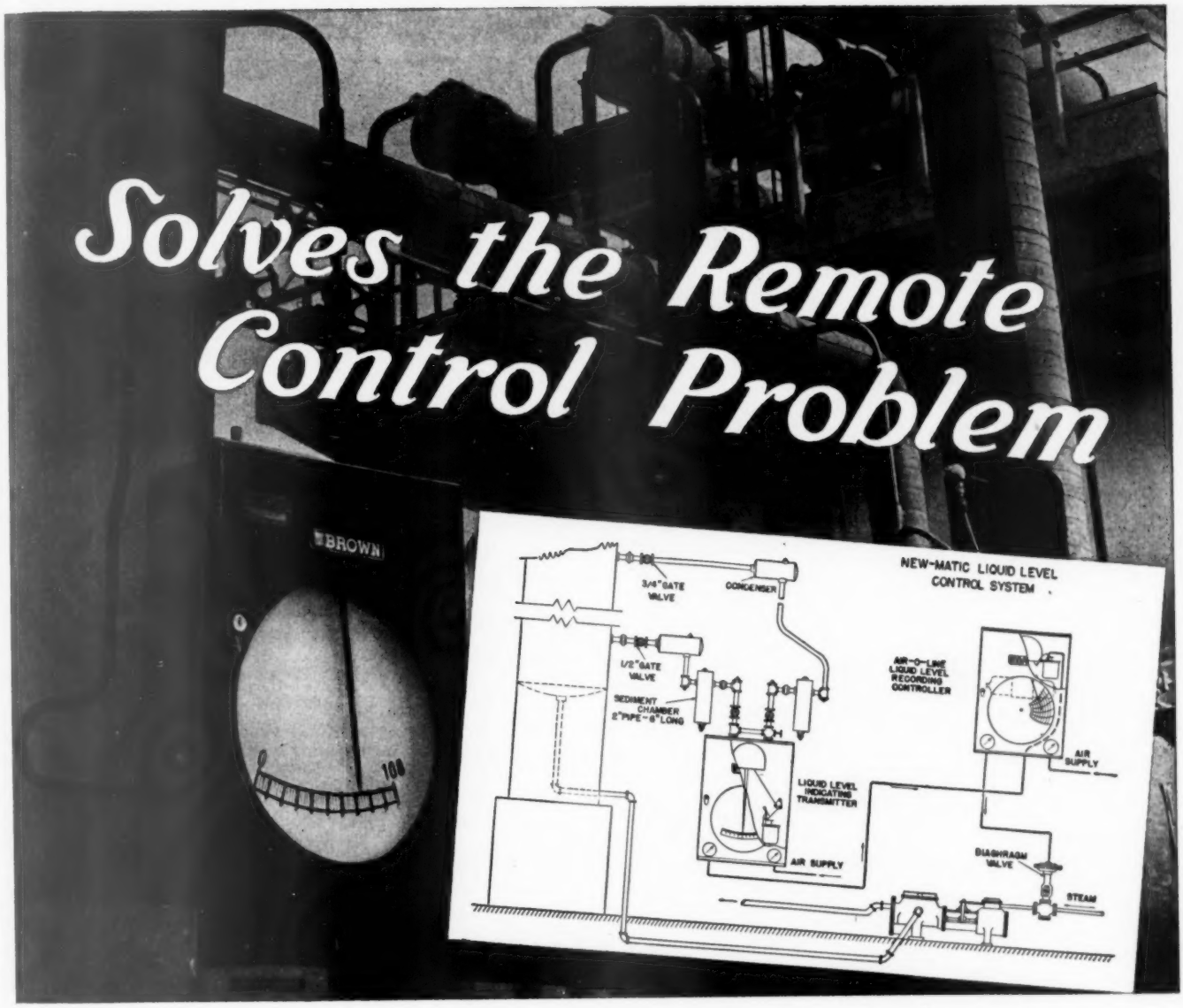


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# BROWN *NEW-MATIC* TRANSMISSION SYSTEM

# University Scientists Study East Texas Oil Field Salt Water Disposal System

THE PRESENT system of salt water disposal in the East Texas oil field in the main is satisfactory and no important changes are warranted at present, University of Texas scientists have concluded.

Geologists, mechanical and chemical engineers and bacteriologists from the University staff made a "joint operational" study of the system, at the request of the East Texas Salt Water Disposal Co., which operates the field's salt water injection system. This company financed the study.

According to a report by the University's Bureau of Engineering Research, improvements to eliminate the remaining shortcomings would be costly and justified only if field experiments first proved that marked increase in efficiency would result.

The investigation, headed by Dr. F. B. Plummer, geologist in the Bureau of Economic Geology, summarized the principal defects in the present salt water disposal system as follows:

1. Corrosion inside the concrete pits and filters.

2. Excessive consumption of chemicals.

3. Imperfect separation of waste oil from the water.

4. Ineffectual elimination of a fine black precipitate of iron sulphide in some of the water.

5. Insufficient stabilization of the bicarbonate which causes hardening of the filter sand and is thought to have the same effect in the water sands after reinjection, especially in the summer time.

Recommendations for future design improvements to correct these defects included:

1. Development of more efficient aerators, strainers and partial filters.

2. Design and construction of nonmetallic filter tanks.

3. Installing the initial aeration and chemical treatment installations on some of the approximate 30 systems in the field closer to the wells where the water is hottest.

4. Improving the design of the settling pits; rearranging them with by-passes to permit cleaning each individual pit without interfering with the operation of the others; having a reserve pit for emergency use.

5. Coating the inside of the filters and concrete pits with asphalt paint, rubber paint, or elastic cement, described as "a tedious and expensive process unless done at the factory where all facilities are present."

Chemical reactions and development of bacteria which occur when water is exposed to the air were analyzed in detail during the investigation.

While the East Texas water is exceptionally high in sodium and chlorides and fairly high in calcium and bicarbonates, the chief chemical products which must be removed before the water is injected are ferrous bicarbonate and calcium bicarbonate, both of which are unstable and tend to react with oxygen in the air to produce precipitates, the report stated.

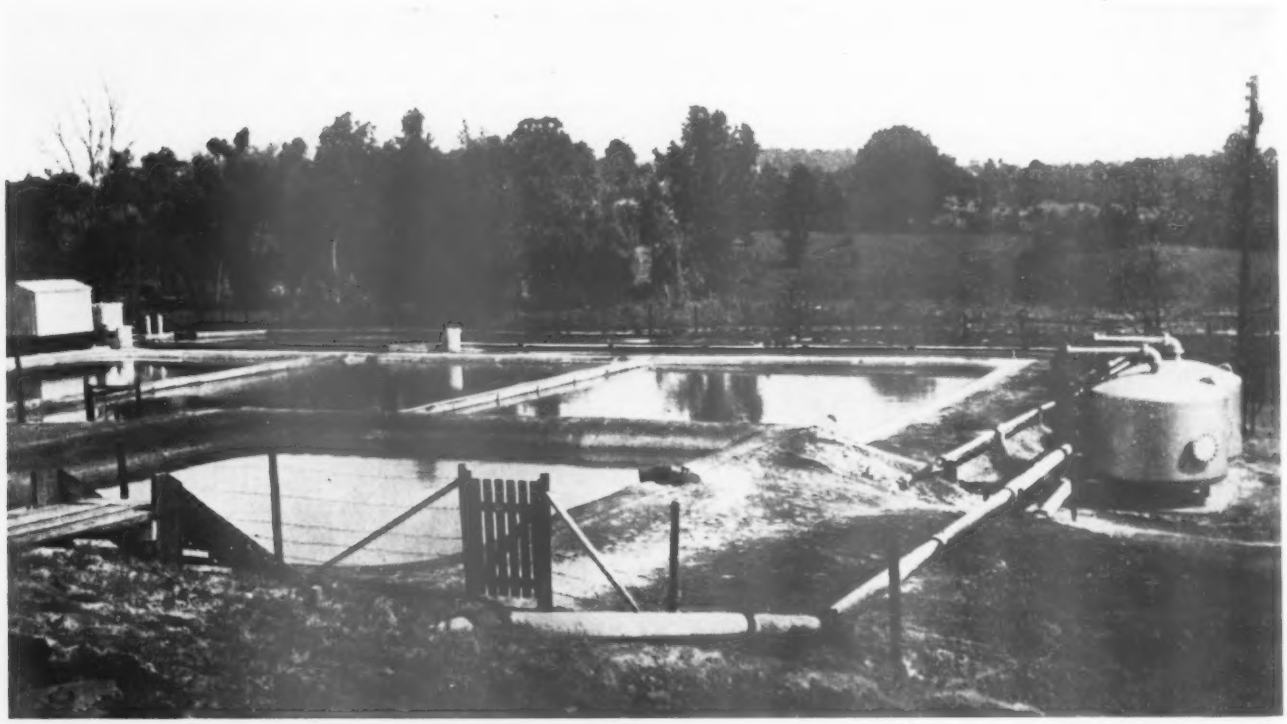
Spectroscopic analyses indicated that traces of other substances such as strontium, manganese, silica and copper were present.

At least five types of microscopic organisms can be detected in the East Texas water after it stands in pits or passes through the water disposal system, all of which appear to play some part in the composition of the insoluble residues filtered from the waters, the report brings out.

Some of these, such as iron bacteria, contribute to the corrosion, while others, such as sulfur bacteria, cause black sludges in the flow lines, tanks and disposal pits. One variety of the sulfur bacteria may be responsible for some corrosion, it was stated.

"It is thought, however, that as long as the East Texas water disposal systems are efficiently operated that micro-organisms do but little harm," the report stated.

The East Texas oil field is a water drive



**Unit of the East Texas oil field salt water disposal system, showing three floc-settling pits in the background, filter installation at the right and filter-wash-water pit in foreground**

field. Small amounts of salt water were produced from wells on the west side of the field from the beginning of development. The field was discovered in September, 1930, and by the end of 1933 salt water production had reached 9000 bbls. daily. By the end of 1936 the approximate 2000 wells were producing about 45,000 bbls. of water daily. It was at this stage of development that the problem of salt water disposal attracted the serious attention of operators. Salt water production in the field has steadily increased and today approximately 450,000 bbls. of water per day are produced while the oil production averages about 375,000 bbls. The disposal of the salt water in the field therefore became one of the major operating problems.

According to W. S. Morris, vice-president and general manager of the East Texas Salt Water Disposal Co., various methods of disposal have been tried in the field. The evaporation of salt water in open pits proved to be impractical, due primarily to the fact that the rate of rainfall was approximately that of the rate of evaporation. The evaporation of salt water with the aid of artificial heat proved too expensive.

The volume of salt water was too great to permit its discharge into the streams where it would kill vegetation and fish life, thus violating the state's pollution laws. Providing a salt water disposal line to the Gulf of Mexico was considered but the estimated cost was too high.

For a time the salt water was stored in large earthen reservoirs and released into the streams during periods of heavy rainfall. While this method was partially successful, the program was difficult to supervise and in addition too many pits were required to store the large volumes during periods of drouth.

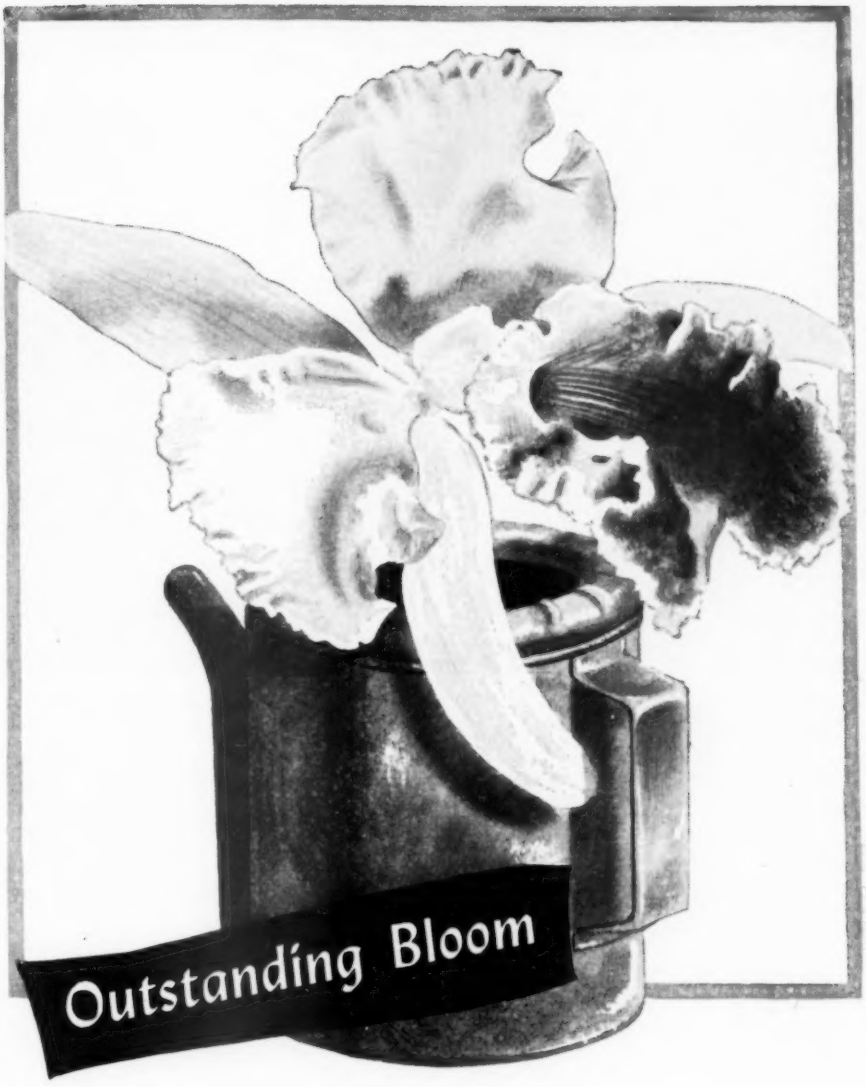
### Disposal by Injection Considered

The disposal of the troublesome water by injection into subsurface formations was believed possible and early in 1936 the method was successfully demonstrated in an experimental well located west of the East Texas field.

Today there are 32 injection wells in operation and over 300,000,000 bbls. of salt water have been returned to the Woodbine formation since the first injection well started operation in June, 1938, the report states.

Subsurface injection of salt water in this particular field serves a dual purpose: first, it has practically overcome the pollution problem; second, the return of the water to the lower part of the Woodbine has maintained the bottom hole pressure in one field to a remarkable extent.

Petroleum technologists recommended to the Texas Railroad Commission that the total withdrawal of oil and water from the field should not exceed 650,000 bbls. per day if reservoir pressures were to be maintained. The maintenance of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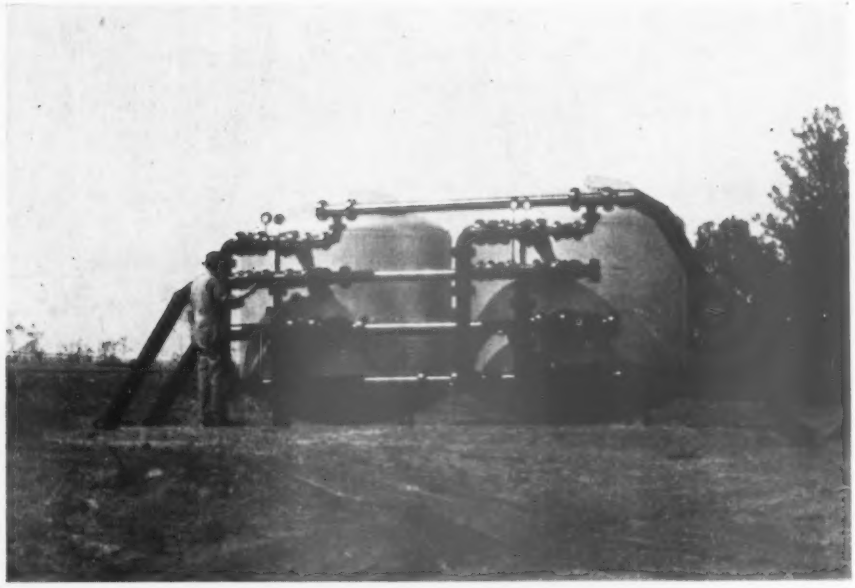
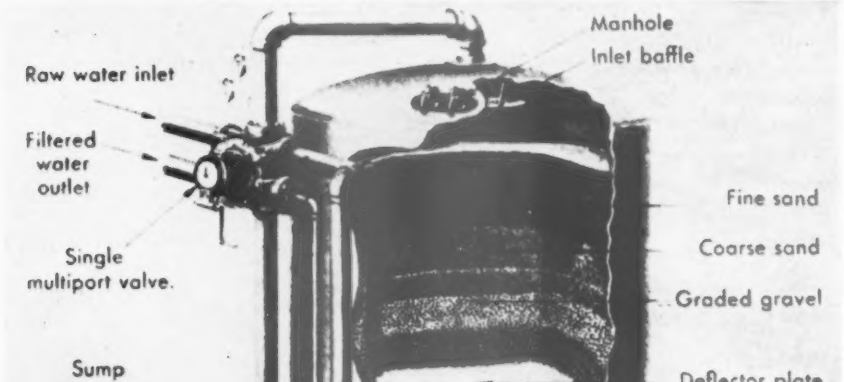


Upper, typical two-unit filter installation in the East Texas salt water disposal system; lower, diagram of the inside of the filter showing arrangement of the sand




pressure was needed for two reasons. First, the dissolved gas in the oil does not come out of solution until the pressure is reduced below 740 psi and, while the gas remains dissolved in the oil, the viscosity is low, thus the oil is able to move through the pores of the sand with facility. Second, when enough pressure is maintained to force the oil to the surface, the oil is produced without pumping.

Especially during the war, the elimination of artificial lift equipment required to pump the oil in itself has been an important factor in the continued high production rate in the field, because of the difficulty of obtaining the equipment. Pumping also runs up the cost of producing the oil. The production of a barrel of water has approximately the same effect on the reduction of reservoir pressure as the withdrawal of a barrel of oil. Consequently the water should be either kept in the ground or returned to the reservoir.

Faced with all the problems of salt water disposal, operators in the field studied the possibilities of organizing a company to take care of them. The East Texas Salt Water Disposal Co. was organized with a capital of $2,000,000. The corporation was perfected in August, 1942, with 249 subscribers to stock, representing ownership of over 16,500 wells in the field. Blessed by both the Texas Railroad Commission and the PAW, the company received high priorities for equipment.

Previously several of the larger operators in the field had set up their own disposal wells, but water produced by other operators could not be taken into these systems. The salt water disposal company drilled wells at strategic points, installed treating plants and extended its gathering lines to all operators in the field regardless of whether they owned stock in the company. The corporation was set up in the nature of a public utility with the same rates to everyone.

The salt water is taken directly from the lease tanks, transported through asbestos cement pipelines to central treating plants and then returned through injection wells to the lower part of the Woodbine sand.

In the operation of the East Texas salt water disposal system, the oil is recovered in the lease tanks by skimming it off the heavier salt water, which is then transported to the central treating plants through asbestos cement pipelines. Unless the salt water is treated before it is injected into the ground it tends to clog the pores of the sand and block off the flow of the oil well. This is caused by a precipitation of iron sulphide in the water, and the removal of this matter has been one of the big problems of the disposal work.

Two systems of treating the water are in use. In the open pits the water is aerated to oxidize the iron so it will settle to the bottom of the pits. In the closed system the water is circulated through large tanks where the iron and other residues are filtered out by passing through sand and other filter agents.

The filter tanks are necessary to strain out the fine particles of floc that do not settle in the open pits. Dr. Plummer explained that these are mostly iron hydroxide from the solution of iron in the tanks, aluminum hydroxide originating from the aluminum sulfate used in treating the water, and dust and fine silt particles from the sand in the concrete tanks. Although these particles are very fine, they would in time clog the underground structure.

The bottomhole pressure of the big field on July 1 was 1003.79 psi, up 5.52 pounds from the previous month. Engineers consider remarkable the fact that the 15-year-old field can gain in pressure in view of the enormous amount of oil it has produced.

The Company's lines now extend over more than 40 miles on the west side of the field where water is produced. Its total gathering system measures more than 150 miles.

A charge of 1.8c per bbl. is made for all water taken from the leases and injected. At this rate a charge of 90c would be made for handling 50 bbls. of water. The Texas Railroad Commission, in order to encourage injection, has granted each operator an extra barrel of oil on his allowable for each 50 bbls. of water injected. This extra barrel of oil, worth around $1.25, is sufficient to pay for the salt water handling charge, the royalty interest and the cost of producing the oil. Thus the operator is able to dispose properly of the salt water produced from his lease without cost to himself, but with considerable benefit to the field.

# Extractive and Azeotropic Distillation

## 1—Theoretical Aspects

*By Manson Benedict and Louis C. Rubin*

In both extractive and azeotropic distillation a solvent not present in the mixture to be separated is added to increase the difference in volatility between the key components. To be effective, the solvent must be present in appreciable concentration in the liquid phase on most of the trays of the column.

The types of distillation differ in the means used to secure useful solvent concentrations. In extractive distillation, the solvent is less volatile than the key components; it is charged near the top, and some is necessarily removed with the bottoms. In azeotropic distillation, the solvent forms a constant boiling mixture with one or more of the key components, and some is necessarily removed with the overhead.

Graphical and algebraic methods of establishing the changes in solvent and key components concentrations from tray in each type of distillation are described. In extractive distillation, the distribution of solvent throughout the column is determined by heat and material input as in a conventional absorber. In azeotropic distillation, distribution of solvent throughout the column is determined largely by phase relationships in mixtures of solvent and key components.

The principal advantages of extractive distillation are:

1. The heat input for a given separation is lower because solvent is not taken overhead.
2. More solvents are available, because the precise nature of phase relationships in mixtures of solvent and key components is not critical to success of the process.

The principal advantages of azeotropic distillation are:

1. When the proportion of overhead is small, less solvent is required.
2. In batch processes, all the solvent required may be charged to the still at the beginning of the distillation.

### *Introduction*

THE object of this series of papers is to analyze and compare the separation processes of extractive and azeotropic distillation, with special reference to the material balance and phase equilibrium relationships controlling separation.

In the first paper of the series, the subject is introduced by an elementary treatment of typical applications of the two processes. A detailed discussion is then given of the theoretical aspects of extractive distillation, and finally a similar discussion is given of azeotropic distillation.

Two ensuing papers of this series will describe

(1) Liquid-vapor equilibria in the system phenol-toluene-heptane-methyl cyclohexane-octene, with application to extractive distillation of mixtures of these substances, and

(2) Liquid-vapor equilibria in the system methanol - toluene - heptane, with application to azeotropic distillation of mixtures of these substances.

In the subsequent papers, a discussion will be given of empirical relationships for representation of phase equilibria in multicomponent systems.*

*Presented at the Philadelphia-Wilmington Section meeting of the American Institute of Chemical Engineers, April 10, 1945; published in the June 25th Transactions of the Institute.*

*Manson Benedict and Louis C. Rubin are members of the Technical Staff of M. W. Kellogg Co., Jersey City, N. J.*

### Sect. I—Elementary Discussion

#### Definition of Processes

Extractive and azeotropic distillation have the property in common that a substance not normally present in the mixture to be separated is added to increase the difference in volatility of the most difficultly separable components. Azeotropic distillation will be defined as a process in which the substance added forms an azeotrope with one or more of the components and by virtue of this fact is present on most of the plates of the column in appreciable concentration.

Extractive distillation will be defined as distillation in the presence of a substance which is relatively non-volatile compared to the components to be separated and which, therefore, is charged continuously near the top of the distilling column so that an appreciable concentration is maintained on all the plates of the column.

#### Applications

Extractive and azeotropic distillation find their principal application in the separation of mixtures whose components boil too close together for economical use of simple fractional distillation. The methods are particularly applicable when the components to be separated differ in chemical structure so that their volatility is changed in differing degrees by the addition of a third substance. It frequently happens that such substances of dissimilar chemical nature which boil close together themselves form azeotropes which are entirely incapable of separation by simple distillation, and in these instances, extractive or azeotropic distillation is absolutely essential if they are to be separated by any type of distillation process.

The most familiar example of azeotropic distillation is the dehydration of ethyl alcohol by azeotropic distillation with benzene.

Extractive distillation has been less commonly used than azeotropic distillation, but in recent years it has been widely employed in the petroleum industry for the separation of paraffins, olefins and di-olefins and for the separation of aromatics from non-aromatic hydrocarbons.

Azeotropic distillation is simply adapted to batch and laboratory operations and for that reason it is the one of these two processes more commonly used on a small scale. A notable example of this application of azeotropic distillation is the separation of a large number of individual hydrocarbons from petroleum fractions by Dr. Rossini and his colleagues at the National Bureau of Standards. In their work a series of partial separations were carried out in which simple distillations and azeotropic distillations were used alternately. Simple distillations classified hydrocarbons ac-

*Of the two ensuing papers referred to, (1) is still in the course of preparation and (2) was presented at the meeting April 10, 1945, of the Philadelphia-Wilmington section of the American Institute of Chemical Engineers. The latter paper, "Extractive and Azeotropic Distillation; 2—Separation of Toluene from Paraffin by Azeotropic Distillation with Methanol," will be reviewed in a later issue of the NPN Technical Section.

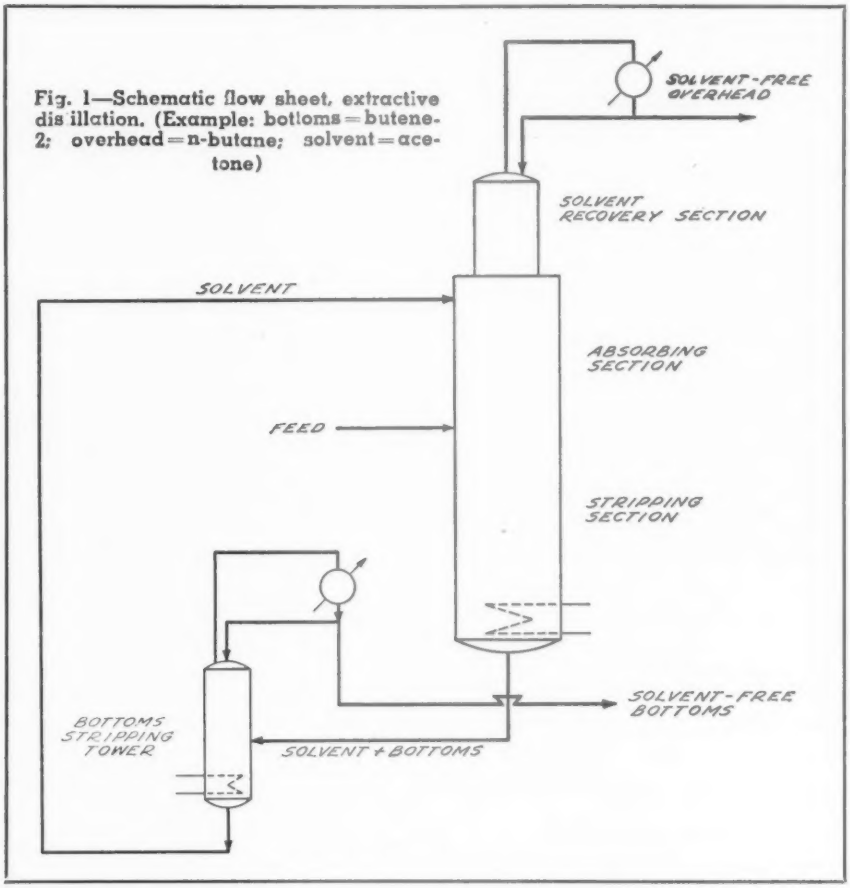



**Fig. 1—Schematic flow sheet, extractive distillation. (Example: bottoms = butene-2; overhead = n-butane; solvent = acetone)**

cording to boiling points, and azeotropic distillations classified them according to chemical type, that is, paraffin, naphthene, aromatic, etc. The success of the azeotropic distillation step of this process is insured by adding to the still with the hydrocarbon mixture a sufficient charge of solvent to remain in the still and column during the entire separation.

Extractive distillation does not lend itself so readily to batch or small-scale operation because the solvent, being relatively non-volatile, must be continuously charged to the head of the column in order to be present on all of the plates during the separation. This is difficult to carry out on a small scale and is primarily responsible for the preference for azeotropic distillation in batch or laboratory operations.

### Typical Flow Sheets

In large-scale, continuous processes, both extractive and azeotropic distillation find valuable application.

Fig. 1 illustrates a typical example of extractive distillation, as for instance, of butene-2 from *n*-butane by means of acetone as a solvent. The heart of the process is the large extractive column, normally consisting of three sections: solvent recovery section, absorbing section and stripping sections. Solvent is charged continuously at the top of the absorbing section and flows through this section and the stripping section. It is found in appreciable concentration in the liquid on all trays below the point of solvent feed. Hydrocarbon feed is charged at some point below the solvent feed and is separated into overhead and bottoms in the absorbing and stripping sections, owing to the presence of appreciable concentrations of solvent. Solvent and bottoms are withdrawn from the bottom of the extractive tower and separated in the bottoms stripping tower, the solvent-free bottoms being removed as overhead and the stripped solvent being returned to the extractive tower. Since the solvent usually has an appreciable volatility, it is necessary to add the solvent recovery section at the top of the extractive tower to separate between solvent and overhead.

The feed in this example consists of two hydrocarbons boiling at almost exactly the same temperature, which could not be possibly separated by simple distillation. However, in the presence of an appreciable concentration of acetone in the liquid phase, the vapor pressures of both *n*-butane and butene-2 are raised, but that of *n*-butane is raised to the greater extent and this *n*-butane is, therefore, taken out as overhead. Butene-2 is bottoms in this example. Acetone, used as solvent in this example, boils about 60° C. higher than the hydrocarbon. However, it is sufficiently volatile to require the use of a solvent recovery section to prevent excessive loss with the overhead.

There are several cases of azeotropic distillation of interest, depending on the miscibility of the solvent with the components to be separated in the liquid state. Fig. 2 illustrates azeotropic distillation with a solvent that is only partially miscible with the overhead product. An example of this process is the separation of toluene from paraffinic hydrocarbons of substantially the same boiling point through the use of nitromethane as an azeotropic solvent.

In this process hydrocarbon feed, together with a small proportion of the azeotrope of nitromethane and toluene,

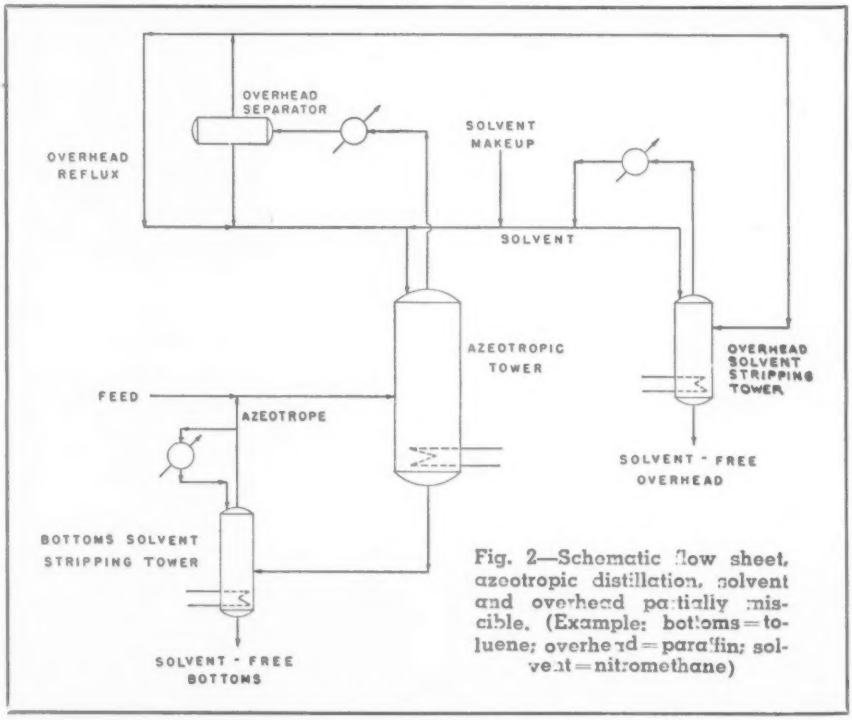



**Fig. 2—Schematic flow sheet, azeotropic distillation, solvent and overhead partially miscible. (Example: bottoms = toluene; overhead = paraffin; solvent = nitromethane)**

F A M O U S

# Caustic Comments

A famous author-humorist had finished an after-dinner speech. The next speaker, an attorney, rose, shoved his hands deep into his pockets, as was his habit, and laughingly remarked, "Doesn't it seem a little unusual that a professional humorist should have to try so hard to be funny?"

Drawled the humorist in a caustic manner, "And doesn't it seem a little unusual that a lawyer should have his hands in his *own* pockets?"

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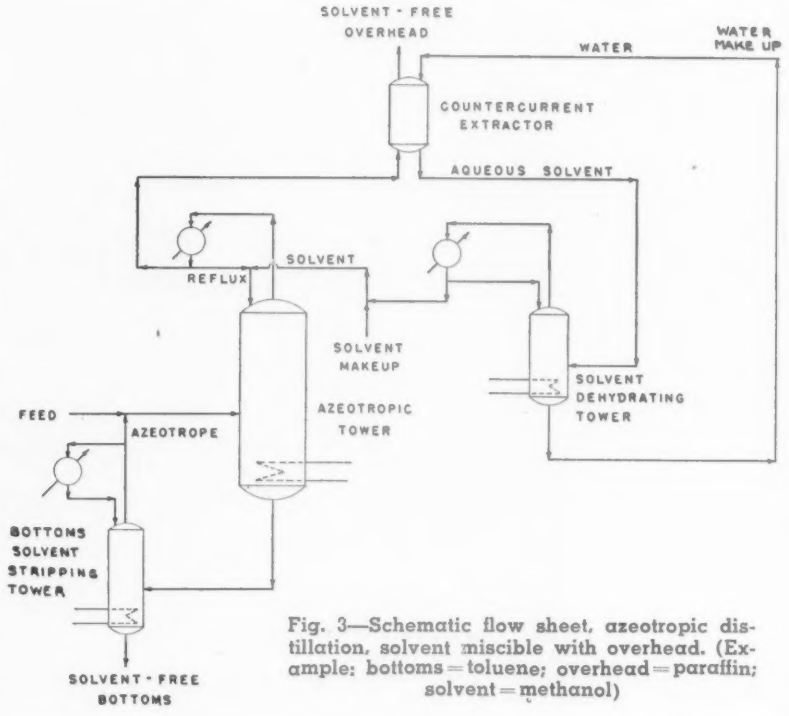


**Fig. 3—Schematic flow sheet, azeotropic distillation, solvent miscible with overhead. (Example: bottoms = toluene; overhead = paraffin; solvent = methanol)**

is charged as feed to the azeotropic tower. This tower is refluxed at the top with a mixture of paraffin and solvent in sufficient proportion to ensure the presence of solvent on most of the trays of the azeotropic tower. Under these conditions, the volatility of the paraffin is increased to a greater extent than that of the toluene and the azeotrope of paraffin and nitro-methane is taken off as overhead. When this mixture is condensed and cooled, it separates into two liquid layers. The bottom, solvent-rich layer is returned to the azeotropic tower and the upper paraffin-rich layer is divided into two parts, part returning to the azeotropic tower as hydrocarbon reflux and the balance being sent to the overhead solvent stripping tower, where the overhead or paraffin is taken off as bottoms and the azeotrope of paraffin and solvent is taken off as overhead and returned to the azeotropic tower.

If an appreciable concentration of solvent is to be maintained on the trays of the azeotropic tower, a certain amount of solvent must be withdrawn with the bottoms from this tower. If desired, this mixture of solvent and bottoms may be stripped of solvent, and the overhead, which in this case will consist of an azeotrope of toluene and nitromethane, may be returned to the azeotropic tower.

In the event that the solvent and components to be separated are miscible, some other means must be found for recovering the solvent and returning it to the azeotropic tower. One example of such a process is illustrated in Fig. 3 by the example of azeotropic distillation of toluene from paraffins of about the same boiling point with methanol.

This application differs from the one just considered in the arrangements provided for treating the overhead of the azeotropic tower. This overhead will consist of the azeotrope of methanol and paraffin. A portion of the overhead is returned directly as reflux, and the balance is treated with water in a countercurrent extractor, from which paraffin is taken off as raffinate and an aqueous solution of methanol is taken off as extract. The extract layer is then separated into water and solvent in the solvent dehydrating tower, and methanol overhead is returned to the azeotropic tower.

### Comparison of Processes

From this brief discussion it will be apparent that these processes are similar in the addition of a solvent which forms non-ideal solutions with one or both of the components and thereby exaggerates the difference in volatility between them. The processes differ in the means used to maintain the desired solvent concentration on the plates of the columns. In extractive distillation the high concentration of solvent is maintained by virtue of its non-volatility and the fact that it is charged at a point high up in the column. Azeotropic distillation may be conceived of as related to extractive distillation if the solvent volatility is sufficiently increased so that an azeotrope is formed with one or both of its components. In extractive distillation the solvent is necessarily taken from the bottom of the principal column. In azeotropic distillation most of the solvent is taken off as overhead, and relatively small amounts are drawn off with the bottoms.

One of the principal advantages of extractive distillation is the fact that more solvents are generally available for a given separation, since the volatility of the solvent does not have to be matched with the volatility of the components to be separated. In extractive distillation it is only necessary that the solvent be appreciably less volatile than the components to be separated. In azeotropic distillation, on the other hand, the solvent must boil at such a temperature that it forms an azeotrope, generally containing from 50-80% solvent.

Extractive distillation also is more flexible than azeotropic distillation in that a wider variety of conditions may be run in a given tower or a wider variety of towers may be designed for the separation of a given mixture. This is because the concentrations of solvent in the tower may be controlled by heat and material inflow rather than by being largely determined through the accident of azeotropic compositions.

A third advantage of extractive distillation is the fact that it is unnecessary to vaporize the solvent, and as a result the heat input for a given separation would usually be smaller than in azeotropic distillation. This is a significant consideration except when the fraction of overhead is small.

As explained earlier, azeotropic distillation is simpler in batch or laboratory operations than extractive distillation because it is possible to charge all of the solvent required for the separation initially to the still, whereas in extractive distillation it is necessary to feed the solvent continuously to the top of the column.

Azeotropic distillation is also useful in large-scale continuous separation when the proportion of overhead to bottoms is small, because in this case the heat required to volatilize the solvent is not a significant fraction of the total heat duty to the process. An example of this is azeotropic distillation to dehydrate ethyl alcohol containing 5% water.

## Sect. II—Extractive Distillation

### Qualitative Discussion of Phase Relationships

Separation by extractive distillation is made possible through the change of relative volatility of key components caused by the addition of solvent to the mixture to be separated. The most common way in which the solvent affects relative volatility is illustrated in Fig. 4.

The chart on the left of this diagram is an $x$-$y$ diagram for the system paraffin-toluene, in which the paraffin is considered as an hypothetical octane having the same boiling point as toluene. The line at zero solvent concentration indicates the existence of an azeotrope of paraffin and toluene. At 50 mol %, it is seen that the azeotrope is destroyed

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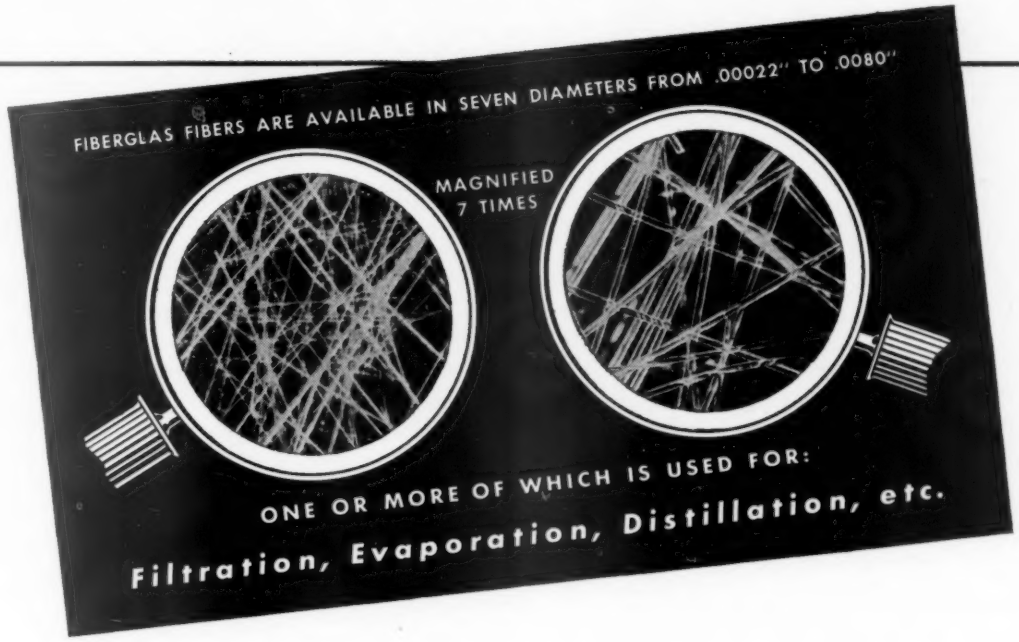
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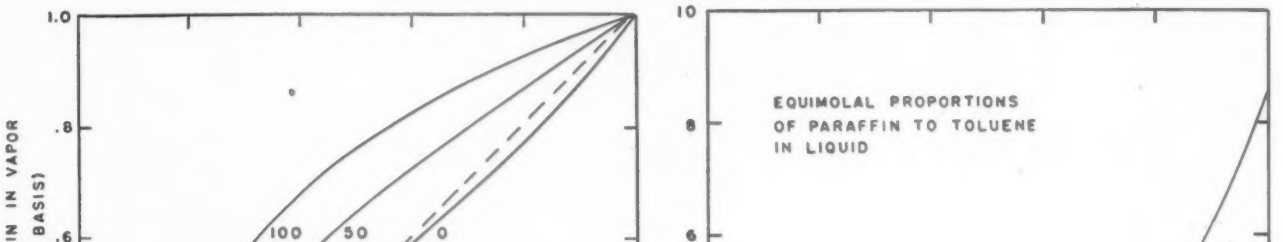
MOL FRACTION PARAFFIN IN VAPOR (SOLVENT - FREE BASIS)
MOL FRACTION PARAFFIN IN LIQUID (SOLVENT - FREE BASIS)
100
50
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NUMBERS ON CURVES REFER TO MOL % SOLVENT IN LIQUID
EQUIMOLAL PROPORTIONS OF PARAFFIN TO TOLUENE IN LIQUID
ACTIVITY COEFFICIENT PARAFFIN
RELATIVE VOLATILITY, PARAFFIN / TOLUENE
ACTIVITY COEFFICIENT TOLUENE
MOL FRACTION SOLVENT IN LIQUID

**Fig. 4—Effect of solvent on liquid-vapor equilibrium. Example: Effect of phenol on paraffin-toluene mixtures)**

and toluene and paraffin become readily separable. The addition of solvent up to 100 mol % increases still further the volatility of paraffin to toluene and renders their separation still easier.

The chart on the right of this figure illustrates typically how the solvent effects the change in relative volatility. This chart refers to the addition of solvent to a mixture of toluene and paraffin in equimolal proportions in the liquid phase. The solvent characteristically increased the activity coefficient (or the apparent vapor pressure) of both paraffin and toluene, but it increases the activity coefficient of paraffin to a greater extent than that of toluene so that the relative volatility, which is proportional to the ratio of the activity coefficients, progressively increases with the mol fraction of solvent. For example, relative volatility is increased from 1.0 at zero mol fraction solvent, at which no separation can be obtained, to about 3.7 at 100%, corresponding to a difference in boiling point of 80° F. This emphasizes the extent to which a solvent can convert a difficult separation process into an easy one.

To take advantage of the selective action of the solvent in extractive distillation, it is merely necessary to run at fairly high solvent concentrations. Solvent concentrations in extractive distillation may be controlled in very much the same way as in simple absorption, by proportioning solvent feed rate, mix-

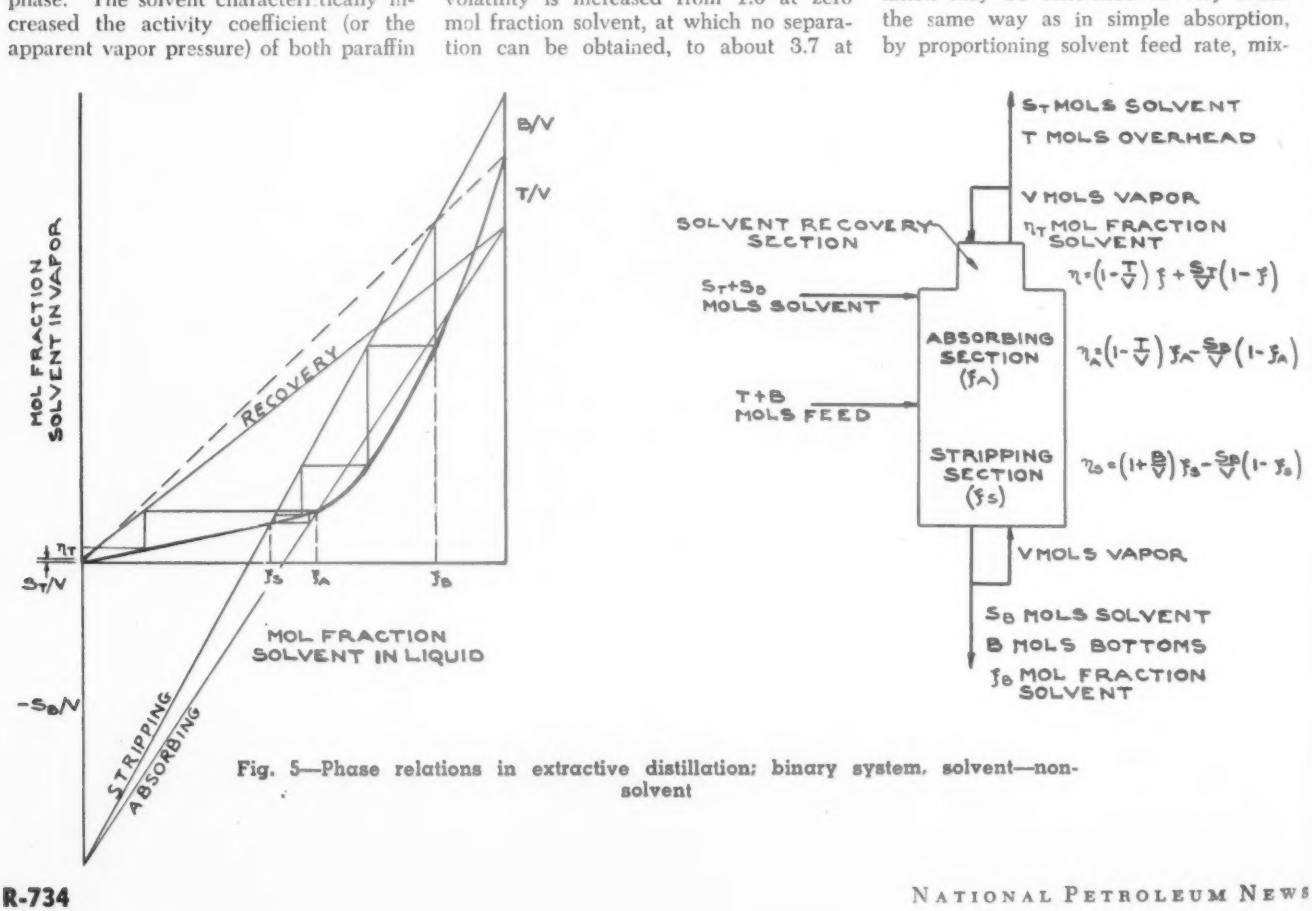


**Fig. 5—Phase relations in extractive distillation: binary system, solvent—non-solvent**

ture feed rate, and heat input to the column.

The various factors which control the solvent concentration are illustrated in Fig. 5, representing the phase relationships in the binary system solvent-non-solvent.

The diagram at the right of this figure represents the feed rate and compositions in the several sections of an extractive distillation column, in which for the purpose of simplification it is assumed that the number of mols of vapor flowing through the column are constant at $V$. The equations for the operating lines in the three principal sections of the column are written at the right of the figure. The mol fraction of solvent in the liquid is denoted by $\xi$ and the mol fraction of the solvent in the vapor is denoted by $\eta$

The diagram at the left of this figure is a McCabe-Thiele diagram illustrating the progression of solvent concentration from point to point in the column. In the stripping section the operating line runs from $-S_B/V$ to $1 + B/V$. In the absorbing section the operating line runs from $-S_B/V$ to $1 - T/V$, and in the solvent recovery section the operating line runs from $S_T/V$ to $1 - T/V$. Working up from the bottom of the column, where the solvent concentration is $\xi_B$, we see that in a relatively small number of plates the solvent concentration remains constant at $\xi_S$. This concentration is plainly affected only slightly by the shape of the equilibrium line. It depends primarily on the stripping vapor ratio $V/S_B$ and bottom composition. In the absorbing section, the solvent concentration is somewhat higher because of the net upflow of non-solvent but it is primarily dependent on the stripping vapor ratio and the reflux ratio, $V/T$. Finally, above the point of solvent feed, the solvent concentration is rapidly reduced in the recovery section to a very small concentration, $\eta_T$.

These features of the extractive distillation column are typical of an ordinary absorber and are described here simply to indicate how the solvent concentration in the liquid on the travs of the extractive tower may be controlled.

Quantitative expressions may be readily derived for the steady concentrations $\xi_A$, $\xi_S$ in the absorbing and stripping sections of an extractive tower. By combining the material balance relationship:

$$\eta = \left(1 - \frac{T}{V}\right)\xi - \frac{S_B}{V}\left(1 - \xi\right) \quad \ldots\ldots (1)$$

with the definition of the relative volatility of solvent to non-solvent ($\beta$),

$$\beta = \frac{\eta}{1-\eta}\left(\frac{1-\xi}{\xi}\right) \quad \ldots\ldots\ldots\ldots (2)$$

and eliminating $\eta$, we obtain:

$$\xi = \frac{S}{(V+S)(1-\beta) - T - T\xi\beta(1-\xi)} \quad \ldots (3)$$




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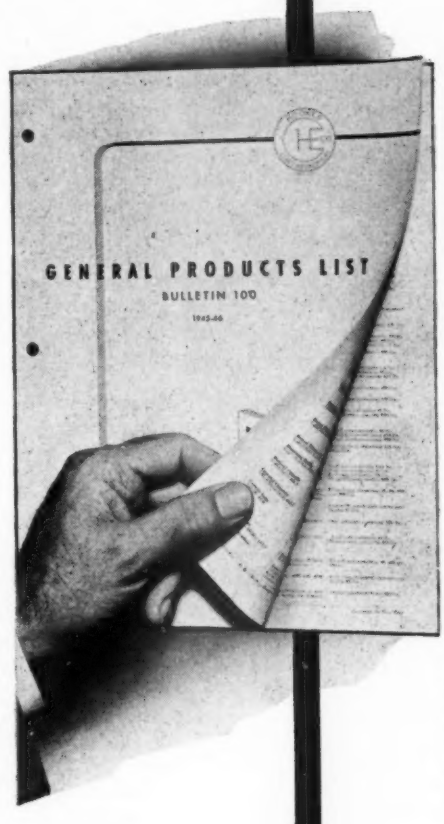


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This may be simplified at high reflux ratios to:

$$\xi = \frac{S}{(V+S)(1-\beta)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Thus the solvent concentration is higher, the higher the solvent rate S, the lower the boil-up rate V and the higher the relative volatility of solvent to non-solvent ($\beta$).

### Analysis of Tower Performance

Fig. 6 illustrates the application of the general treatment of multi-component distillation problems to the analysis of tower performance in extractive distillation. The diagram at the right of the figure illustrates the progression of concentrations in the extractive tower from the bottoms product $X_B$ to the overhead product $Y_T$. The flow rates of the streams fed to the column and entering and leaving each tray are defined in the diagram at the left of this figure.

Material balance equations are given for the three principal sections of the column. In these equations $X_i$ is the mol fraction of liquid leaving the tray and $Y_{i-1}$ is the mol fraction of vapor entering the tray from the one next below in the column. Each equation is really a set of equations to be written for each component of the mixture.

The diagram at the right of the figure is intended to represent the system phenol, toluene and paraffin of the same boiling points as toluene. It is assumed that the toluene and paraffin form a minimum boiling point azeotrope at 107°C. Tie lines connecting compositions of liquid and vapor in equilibrium are tangent to the curved lines of this figure. The effect of phenol in increasing the volatility of paraffin relative to toluene is indicated by the fact that the lines in the phenol corner of the triangle cut across lines radiating from point Z in the direction of the paraffin corner of the diagram.

The solid lines of this triangular diagram represent the equilibrium steps connecting the composition of the liquid on the tray such as $X_1$, with composition of the vapor leaving the tray, such as $Y_1$.

The dashed lines of this figure represent material balance relationships connecting the composition of the vapor flowing up from the tray, such as $Y_1$, with the composition of the liquid flowing down from the next tray, such as $X_2$.

The liquid compositions in the absorbing and stripping sections are located on these dashed lines at the center of gravity of the corresponding vapor points and the points representing the net downflow, $X_B$ in the stripping section or $(SZ - TY_T)/(S - T)$ in the absorbing section. The weights used in arriving at the center of gravity on these lines are the ratio of vapor upflow to liquid downflow for the vapor composition and the ratio of the net downflow to total liquid downflow for the net downflow composition.

A similar situation exists in the solvent recovery section, with material balance lines radiating from the net upflow point $Y_T$. This graphical method for representing material balances in a three-component system is similar to that used by Bonilla.*

We may now trace the progression of liquid and vapor compositions from the bottom to the top of the solvent recovery section. The vapor at $Y_{-5}$ is in equilibrium with bottom product of composition $X_B$. Liquid leaving the next to the bottom tray of composition $X_{-4}$ is located at the center of gravity between $X_B$ and $Y_{-5}$. Vapor from the next to the bottom tray is located on the tie line through $X_{-4}$ at $Y_{-4}$. Progressing in this way, the vapor composition changes to $Y_0$ leaving the tray below the point of liquid feed.

It will be noted that after a few trays from the bottom of the tower, the mol % solvent in the liquid has reached a fairly steady value, but that the ratio of paraffin to toluene progressively increases. At $Y_0$ a new material balance radiating point (above the phenol corner of the triangle) is used, and the liquid composition changes in a discontinuous manner. From this point on, the phenol composition remains substantially constant while both liquid and vapor are enriched still further with respect to paraffin. When vapor of the composition $Y_3$ is reached at the top of the absorbing section the composition of the liquid $X_4$ flowing down from the solvent recovery section lies on a new material balance line through the net upflow point $Y_T$. The final steps of the distillation quickly reduce the solvent concentration and somewhat increase the ratio of paraffin to toluene.

This qualitative discussion of phenomena in extractive distillation may be supplemented by quantitative expressions illustrating the relationship of the factors affecting the separation of toluene from paraffin. In addition to the symbols defined previously the relative volatility of paraffin to toluene, $\alpha$, is involved. The equation:

$$Y_{i-1} - Y_i = Y_i(1-Y_{i+1})(\alpha-1) - \frac{[TV(1-\beta)Y_T][\alpha - Y_{i+1}(\alpha-1)]}{[V+S-T][V(1-\beta)-S\beta]} \quad \ldots (5)$$

represents the difference between the composition of the vapors from two adjacent trays. The principal variables affecting this expression are—

1. The product rate—$T$
2. The solvent rate—S—which affects $\alpha$ through its effect on the solvent concentration
3. The boil-up rate—$V$—which affects $\alpha$ through its effect on the solvent concentration
4. The choice of solvent which affects $\alpha$ and $\beta$.

Obviously the higher the product rate, $T$, the lower the separation.

A high solvent rate is beneficial in two ways—

(a) By increasing S and thereby reducing the second term of this equation, and

(b) By increasing the mol fraction of the solvent in the liquid and thereby increasing the $\alpha$ for a particular solvent.

However, the high solvent rate increases the size of the extractive tower and of the solvent stripping tower and, therefore, has an optimum value in practice.

An increased boil-up rate, $V$, will increase the separation by reducing the last term through the usual effect of increasing the reflux ratio $(V/T)$ but will also reduce the value of the first term by reducing the mol fraction of the solvent in the liquid and thereby reducing $\alpha$. There is thus an optimum boil-up rate, $V$, resulting in maximum enrichment per tray. This is an unusual property common to all examples of extractive distillation. Too low a boil-up rate results in too low a reflux ratio, and too high a

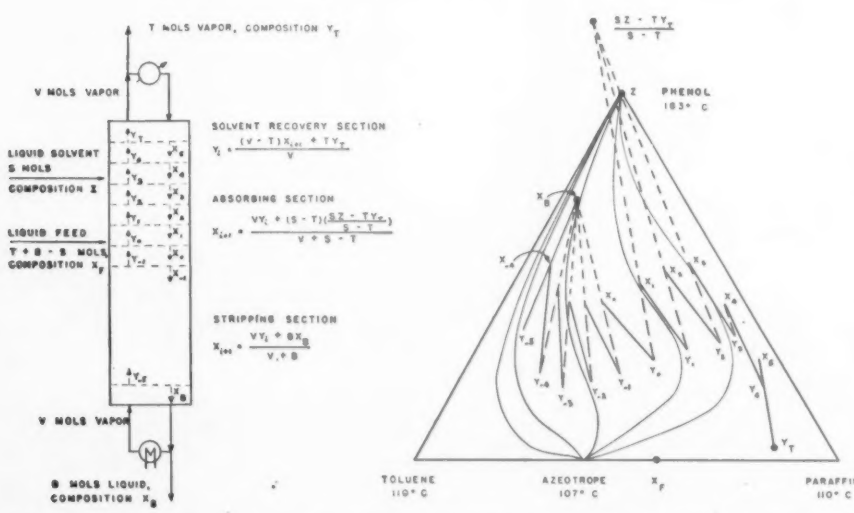


**Fig. 6—Outline of tower performance in extractive distillation. (Example: Separation of toluene from paraffin with phenol as solvent)**

*C. F. Bonilla, *Trans. Am. Inst. Chem. Eng.*, 37, 669 (1941).

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boil-up rate results in too low a solvent concentration.

### Requirements of Solvent

The choice of a solvent for a particular separation will be affected by technical considerations of

(1) Selectivity
(2) Volatility
(3) Capacity, that is, maximum non-solvent concentration that can be built up in the solvent without separation of a second liquid layer or freeze up of the solvent, and
(4) Separability of the solvent from non-solvent.

Solvents may be rated for selectivity by the relative volatility of one key component to another at a particular solvent concentration. For instance, in separating toluene from paraffin, solvents can be rated for selectivity by tabulating the relative volatility of paraffin to toluene at 80 mol %, 10 mol % toluene and 10 mol % paraffin. Under these conditions, phenol results in a relative volatility of 2.90 and cresol, 2.33. Other things being equal, the higher the selectivity defined in this way, the better the solvent and the higher the enrichment per tray.

The volatility of the solvent affects the enrichment per tray in two ways: (1) the higher the relative volatility of solvent to non-solvent, the larger the mol fraction of solvent in the vapor and the poorer the separation for a given reboiler duty, and (2) the higher the relative volatility of solvent to non-solvent, the higher the solvent concentration in the liquid, and the higher the $\alpha$, for given solvent and non-solvent rates.

The first factor usually dominates, and, in general, the higher the volatility of the solvent, the poorer the enrichment per tray for a particular reboiler duty and a particular solvent selectivity. Carrying this statement to its logical extreme, when a solvent becomes sufficiently volatile, the process becomes one of azeotropic distillation, which has a lower enrichment per tray than extractive distillation for a particular selectivity and a particular reboiler duty.

It is frequently true that solvents which are only partially miscible with one or both constituents in the mixture are very selective. It is thus often necessary to balance the selectivity of a solvent against its capacity, that is, in the number of mols of solvent which are required to treat a single mol of non-solvent. In general, if a homologous series of solvents is available, it is generally best to select the one which is just miscible in all proportions with non-solvent at the operating temperature, since the largest selectivity is usually obtained in this way.

If the solvent is sufficiently non-volatile relative to the non-solvent, there is usually no difficulty in separating the solvent by distillation. On the other hand, because of the abnormal volatility relationships found for a truly selective solvent, it is frequently necessary to establish that the solvent does not form an azeotrope with one or more constituents of the non-solvent even though their boiling points may be 100° F. apart. If it is desired to use an azeotrope-forming solvent, then some other simple means for separating it must be available, such as water washing or solvent extraction.

## Sect. III—Azeotropic Distillation

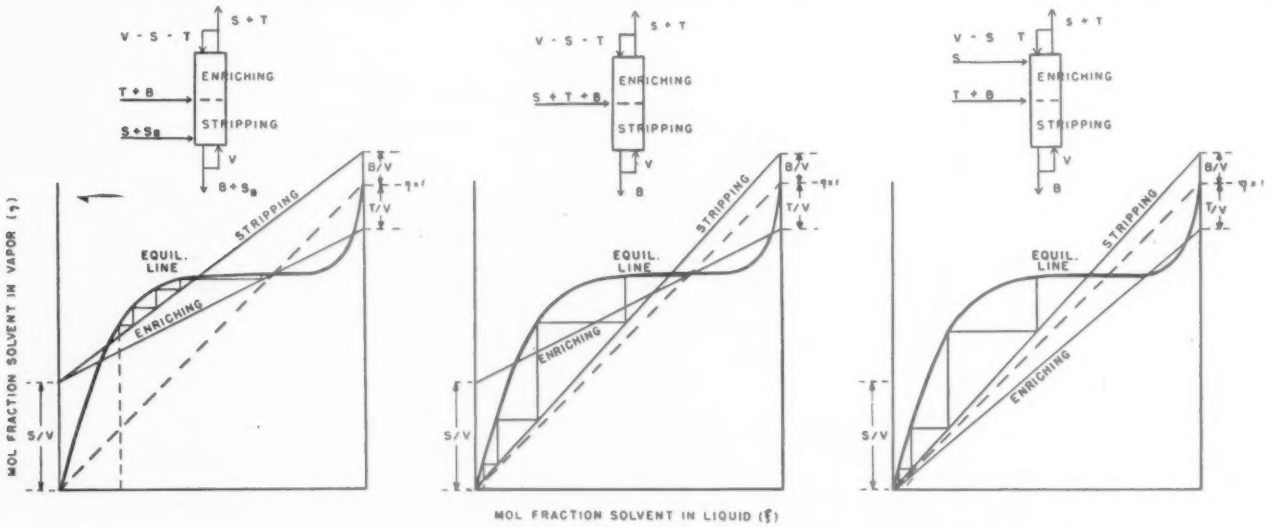
In many respects the discussion to be given of azeotropic distillation parallels that already given of extractive distillation. One important exception, however, is the fact that detailed consideration must be given the volatility of the solvent relative to the components being separated because the volatility relationships, rather than heat and material balance considerations, largely determine the solvent concentration at points in the column.

### Analysis of Tower Performance

Accordingly, an analysis of the factors determining the solvent concentration in azeotropic distillation will first be given. The heavy line in Fig. 7 is a hypothetical equilibrium line for the binary system solvent-non-solvent. In this system, an azeotrope is formed where the equilibrium line crosses the dashed 45° line. As is characteristic of systems forming an azeotrope, the equilibrium line is nearly horizontal for a considerable distance around the point of intersection.

The figure illustrates three different methods of introducing azeotropic solvent. Equations for material balance lines in the enriching and stripping sections are given at the foot of the figure. In the left chart the solvent is assumed introduced at the bottom of the column. Since the solvent is introduced at the bottom of the stripping section, the stripping and enriching lines both radiate from S/V and insure that both sections of the column are refluxed with some solvent. However, it is not possible to build up a high concentration of solvent in the stripping section and this section of the column may, therefore, not operate at maximum efficiency. Moreover, some solvent, $S_B$, necessarily remains unstripped from the bottoms.

When the point of solvent feed coincides with the principal feed point, as in the middle chart, the composition in




Material Balance Equations

Enriching Section:
$$\eta = \xi\,(1 - T/V) + (1 - \xi)\,(S/V)$$
Stripping Section:
$$\eta = \xi\,(1 - B/V) + (1 - \xi)\,(S/V)$$

Flow Rates

$S$ = solvent in overhead
$B$ = bottoms hydrocarbon
$T$ = overhead hydrocarbon
$V$ = vapor
$S_B$ = solvent in bottoms

**Fig. 7—Liquid-vapor equilibrium in azeotropic distillation: solvent—non-solvent**

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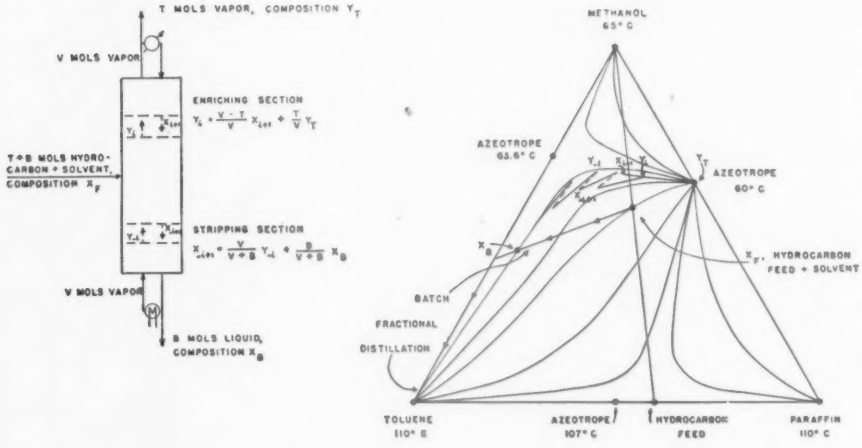


**Fig. 8—Azeotropic distillation in system containing three binary minima and no ternary azeotrope. (Example: methanol-toluene-paraffin)**

the stripping section can build up almost to that of the azeotrope and the bottoms from the stripping section can be stripped practically completely of solvent. For these reasons, introduction of the solvent at this point is preferable to introducing it below the principal feed point.

When the point of solvent feed is moved to the top of the column, as is done in the right hand chart, it is seen that the solvent concentration distribution in the stripping section remains unchanged and that the concentration in the enriching section is increased still further. This point for introducing solvent is generally the best of all, providing the column is not too hard to control, because of the possibility of stripping all of the solvent from the lower plates.

The point to be stressed in these figures is that the mol fraction of solvent in the liquid and vapor and its distribution throughout the column is determined very largely by composition of the azeotrope and the nature of the equilibrium line. Since these factors are affected to a considerable extent by the composition of the non-solvent, it is apparent that solvent concentration will depend on the exact course of the distillation from point to point in the column in a complicated manner and that analysis of azeotropic distillation can not be so readily generalized as that of extractive distillation. Many special cases may be found depending on the detailed character of liquid-vapor equilibrium for the multi-component system being distilled.

Fig. 8 is one example of the course of azeotropic distillation, illustrating schematically the course of azeotropic distillation of mixtures of methanol, toluene, and a paraffin of the same boiling point as toluene.

The curved lines on the right chart of this figure are indicative of the liquid-vapor equilibrium assumed for this system. Three binary azeotropes are formed of which the one with the lowest boiling point is on the methanol-paraffin side of the triangle.

The tie lines joining the composition of liquid and equilibrium vapor are tangent to the curved lines shown in this figure. These lines emanate from the lowest boiling azeotrope and extend to the three points at highest temperature in the figure at the three corners of the triangle. It is assumed that no ternary azeotrope is formed.

This figure will be used to illustrate the course of several types of distillation starting with a mixture of hydrocarbon feed and solvent of the composition $X_F$. If this mixture is subjected to simple batch distillation without fractionation, the liquid in the still will move progressively to the left along the curved line from $X_F$, until pure toluene remains. If the vapor of this composition is progressively condensed, the composition of the remaining vapor will move along the curved line to the right of $X_F$ until only the azeotrope $Y_T$ remains. If a mixture of the composition $X_F$ is subject to batch fractional distillation, the vapor given off will have the composition $Y_T$, and the liquid in the still will move progressively along the line of arrows until the left side of the triangle is reached after which the azeotrope of methanol and toluene will be given off and the liquid in the still will move toward the toluene corner.

Change in composition from tray to tray in a continuous fractionating column is indicated by the broken line in the figure in the same manner as was done in extractive distillation.

Material balance equations for enriching and stripping sections are given for the case under consideration in the diagram at the left of the figure. A separate equation is implied for each component of the mixture. In the stripping section, the vapor in equilibrium with the bottoms $X_B$ is at the end of the solid line through this point. Liquid flowing down from the tray above the bottom is on the line joining these two points at their center of gravity with weights given in the material balance equation for the stripping section. By proceeding in this way, the composition of the liquid becomes progressively richer in methanol and paraffin as one moves up the column. The material balance lines continue to radiate from the point $X_B$. When one passes the feed point and enters the enriching section, the material balance lines now radiate from the top product composition $Y_T$, the methanol-paraffin azeotrope. Since these are almost colinear with the tie lines, it is not possible to represent them separately in the figures and the fractionation may be considered to move backward and forward along the line joining $X_{i+1}$ and $Y_T$, moving eventually to the latter.

The solvent concentration throughout the azeotropic column may vary greatly with the particular points chosen for the azeotrope and the bottoms composition. For instance, if pure toluene were withdrawn from the bottom, the stripping section of the column might operate at relatively low methanol concentrations. Again, if the methanol-toluene azeotrope were of much higher methanol concentration, the methanol concentration might reach a maximum in the stripping section and then drop off in the enriching section. On the other hand, if methanol and toluene formed no azeotrope, the methanol concentration might remain low until quite a high paraffin concentration had been built up. These points are stressed because they indicate how important is a detailed knowledge of the liquid vapor equilibrium to predict success or failure of a proposed azeotropic distillation process.

### Requirements of Solvent

The choice of solvent for azeotropic distillation depends on considerations very similar to those discussed under extractive distillation. The only novel feature is the one just referred to, namely, that the volatility of the solvent should be such that high solvent concentrations are maintained at different points in the column. This limitation is rather a strict one, and in practice reduces the number of solvents which may advantageously be used.

#### Nomenclature

$B$ = mols of bottoms hydrocarbon
$S$ = mols of solvent
$T$ = mols of overhead hydrocarbon
$V$ = mols of vapor
$X_i$ = mol fraction of liquid leaving the $i^{th}$ tray
$Y_i$ = mol fraction of vapor leaving the $i^{th}$ tray
$x$ = mol fraction of the liquid phase
$y$ = mol fraction of the vapor phase
$\alpha$ = relative volatility of paraffin to toluene
$\beta$ = relative volatility of solvent to non-solvent
$\eta$ = mol fraction of solvent in vapor phase
$\xi$ = mol fraction of solvent in liquid phase

#### Subscripts

$A$ = absorbing section
$B$ = bottoms
$F$ = feed
$S$ = stripping section
$T$ = overhead

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# Keeping Up With the News

*By N.P.N. Special Writer*

**This series consists of brief, technical-economic accounts of current developments in scientific and industrial circles which may relate to the future of the petroleum industry.**

**Attention in recent weeks has been especially focused on such subjects as petroleum hydrogenation, automobile developments, petroleum chemicals, petroleum substitutes and the marine gas turbine. These topics are discussed in the current article.**

**The author of this series is a chemical engineer in the employ of the research subsidiary of one of the larger oil companies. His duties include a continuous survey of the current technical and economic journals in the many fields now related to petroleum operations.**

## *Petroleum Hydrogenation*

The petroleum industry has now been flirting with the idea of using destructive hydrogenation as a refining process for nearly 15 years. It came so near once that 18 major companies reached a patent agreement on the subject (the now-extinct Hydro Patents Co.). But, except for a few fair-sized plants built in the early thirties by Jersey Standard, its chief domestic proponent, one thing and another have combined to keep its use just around the corner.

Not that interest has been allowed to lapse; commercialized "fringe" processes have added to the available knowledge—the hydrogenation of dimers and codimers, and hydroforming. Research on the hydrogenation of coal (and intermediates of this process) has been directly pertinent, as have new data on the hydrogenation of coal tars. From the extent of the available literature, one could hardly realize that destructive hydrogenation has not yet been commercialized here.

Such has not been the case abroad, of course. The petroleum industry and the public alike are familiar with German accomplishments in the hydrogenation of coal—a two-stage process in which the middle oil from the first stage is hydrogenated in the vapor phase, just as is gas oil, while the coal, sludged with heavy recycle oil, is charged to the first reactor (liquid phase) and hydrogenated in a manner similar to that used for heavy residues.

Similarly, considerable information has been available on Britain's coal hydrogenation plant at Billingham, built in 1935 in an effort to help render England less dependent upon imports.

It is therefore of interest but no great surprise to learn that high-pressure gas oil hydrogenation has been used in England during the war to aid in the production of aviation gasoline. A large new plant is said[1] to have been built under the supervision of Shell; Imperial Chemical Industries, Ltd.; and Trinidad Leaseholds, Ltd.

Five units in all are available for the hydrogenation process proper, which is carried on in two stages. The size of the plant may be judged from the fact that the hydrogen required is produced from coke in six water gas generators having a capacity of 200,000 tons of coke per year. This hydrogen is then compressed to 5,000 p.s.i. by five-stage compressors of 2,000 h.p. each.

Additional aviation gasoline stock is made from the butane produced; it is dehydrogenated and the butylenes then polymerized and hydrogenated.

The Billingham hydrogenation plant of Imperial Chemical Industries, Ltd., has been operating, during the war, on creosote instead of coal, yielding an "aviation base stock whose quality is without equal." Imperial Chemical Industries, Ltd., is also producing "Victane," butylbenzene, made by alkylating benzene from coke ovens with butylene obtained by butane dehydrogenation. This rich-mixture agent is the British equivalent of cumene. "Latterly, Britain's fuels have contained, in addition to isooctane and butylbenzene, a small proportion of an ultra-effective blending agent for improving rich mixture performance. This is an amino compound."

Petroleum hydrogenation is an intriguing process. Millions have been spent on it for research. Fundamental principles are thoroughly understood, as are its economics—which show that it may someday be used on a large scale on petroleum residues and low-grade crudes and distillates if the cost of petroleum rises sharply (as is not improbable). Meanwhile, many companies continue their research in an effort to be ready.

(1) Anon., *Petroleum Times* 49, No. 1,-249, 423 (1945), "Britain's Unique Contribution to Allied Aviation Fuel Supplies."

## *Petroleum Chemicals*

The tempo of developments in this "new" branch of petroleum refining continues to increase as the war nears its end and construction materials again begin to become available. Wartime construction is also playing its part, since numerous DPC-financed chemical plants will shortly be in the surplus category.

Several petroleum companies have indicated their intention, in recent weeks, of expanding their operations in the chemical field. Among these are the Standard Oil Co. (Indiana) and the Lion Oil Co.

Indiana Standard has organized a chemical products department, in recognition of "the increasing importance of manufacture of chemical products from petroleum." General direction of the new department will be in the hands of Bruce K. Brown, vice president in charge of development, while William B. Plummer will have the position of manager.

According to Plummer, the new catalytic refining processes now overshadowing older methods "are making new chemical byproducts available and paving the way for still further development in the petroleum chemicals fields." Plummer, incidentally, points out a fact which has deterred many refining companies from entering the field; "the market for these (formaldehyde, methanol, acetic acid, etc.) and less known petroleum chemicals is ordinarily among manufacturers of basic materials or consumer products," rather than in direct sale to the public, the case for normal petroleum products.

In regard to Lion Oil, this company until recently was known as the Lion Oil Refining Co. Under its new incorporation papers, Lion can now engage in the manufacture of chemicals, plastics, synthetic rubber, and other "unusual" petroleum products.

Prime motive for this change appears to be the imminent purchase by Lion of the $30,000,000 ammonia plant built by its subsidiary, the Lion Chemical Corp., under Government sponsorship (and ownership). Lion Chemical is said to have the contractual right to buy this plant through direct negotiation or by matching the highest bid.

It is reported that the War Department has given the RFC the au-

thority to convert this plant to private production, probably for the manufacture of ferilizers.(2) This source reports that Lion Chemical has been invited to contract for an operating agreement leading to outright purchase.

Permission was given last October for the installation of $1,300,000 worth of graining facilities, necessary to convert the plant to fertilizer production, but installation was delayed by the German counter-offensive last December and is only now nearing completion. It is said that the plant must be kept in full military operating condition until VJ-Day and must be able to be reconverted within six months at any time thereafter.

Several other interesting announcements have also been made by other companies. The Shell Union Oil Corp. has announced plans to construct a $2,000,000 isoprene plant at Torrance, Calif. This plant will reportedly double the output of this chemical under the government's synthetic rubber program and this gives rise to speculation as to its location on the West Coast, since both Butyl rubber plants (chief present user of isoprene) are located much farther east (in Texas and Louisiana). No clue to this was given in the announcement.

The Celanese Corp. of America has revealed that its large chemical plant near Bishop, Texas, has recently started operations. First large-scale plant "to produce certain chemicals by a process using natural gas as a raw material," this unit will produce acetic acid, acetic anhydride, acetone, methanol, and formaldehyde.

A second unit of the plant, three-quarters complete, will be devoted to the production of butadiene; this unit was discussed in an earlier article.(3) It seems possible that both units will make use of the oxidation of light hydrocarbons (methane-butane), perhaps similar to the process pioneered on at least a large pilot-plant scale by Cities Service.(4) Much research has been conducted on such processes, and it is not at all unlikely that further use will be made of them.

According to report, du Pont intends to produce the chemical intermediates for nylon production (adipic acid and hexamethylene diamine) from cyclohexane separated from petroleum naphthas, where it is present to the extent of 1-4%. Hydrogen is also required, and this will be pro-

(2) Anon., *Wall Street Journal* 126, No. 20, 5 (1945).

(3) Anon., NATIONAL PETROLEUM NEWS, *Technical Section*, 36, No. 40, R-723 (1944), "Keeping Up With the News—Butadiene from Petroleum Gas."

(4) Anon., NATIONAL PETROLEUM NEWS, *Technical Section*, 37, No. 23, R-458 (1945), "Keeping Up With the News—Formaldehyde."

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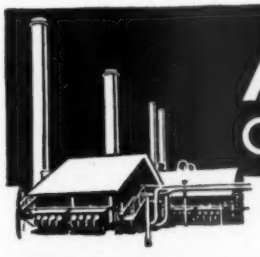

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duced from natural gas. The new $20,000,000 nylon plant is being built at Orange, Texas and is expected to be ready early next year.

It is increasingly evident that petroleum has become an accepted raw material for chemical synthesis. The "band-wagon" has started rolling, but new riders must take precautions against falling off, for the road contains many bumps not present for normal petroleum operations.

### Petroleum Substitutes

Several interesting events have occurred in recent weeks. Chief among these is the announcement by Hydrocarbon Research, Inc., that it will direct the construction (this summer), of a commercial Synthine (Fischer-Tropsch) plant, to be erected in East Texas.

This plant will have a capacity of 7,000 b/d of finished products, 80 to 85% of which will be high-octane motor gasoline. Production will be at the rate of one barrel of oil per 10,000 cubic feet of gas. The process to be used is said to have been developed by Hydrocarbon in the past 20 months, under a research program financed by three oil producers: the Magnolia Petroleum Co., a subsidiary of the Socony-Vacuum Oil Co., Inc.; the La Gloria Corp., organized by a group of producers in the La Gloria field of East Texas to unitize operations there; and the J. S. Abercrombie Co., discoverer and developer of the Old Ocean field near Houston, Texas.

P. C. Keith, president of Hydrocarbon Research, has stated that two of his technicians have just returned from Germany and have agreed that his process is up to date as regards German research (which, incidentally, was always ahead of actual German production techniques).

According to Mr. Keith, his process is based on German laboratory research applied to American oil industry engineering techniques concerning plant design and construction and the use of cheaper catalysts. The plant, it is said, will be constructed at a fraction of the cost of similar German plants and will produce higher quality gasoline.

In regard to tar sands operations the Canadian government is returning the operation and ownership of its McMurray tar sands project in Northern Alberta to a reorganized, privately-financed Abasand Oils, Ltd., the concern which spent about $1,000,000 on tar sands research prior to 1943. Abasand will repay the Dominion from anticipated revenue, on a long-term basis. It will immediately replace the 600 b/d separation plant, destroyed by fire on June 16, with a 1000 b/d unit costing $300,000-$350,000. Construction is expected to be completed before the end of the year.

The 1200 b/d refinery will be taken over intact. Transportation costs to markets are expected to be arranged through the Canadian Government; the primary move will probably be a cut in freight rates on the Northern Alberta Railway which links the Abasand operations at Waterways with Edmonton. During the period of Dominion operation, $1,750,000 of Government funds were used for research.

The third recent development concerns the production of oil from oil shales.[5] The Socony-Vacuum Oil Co. Inc. has placed at the disposal of the Bureau of Mines the results and blueprints of two years of pilot-plant work on the extraction of oil from shales in a countercurrent vertical retort.

In this retort, the crushed shale, preheated to 500° F. by contact with the exit gases, is introduced at the top and falls through a stream of hot gases which bring its temperature to 1000° F. and sweep the oil vapors from the retort, after which the oil is recovered in a series of condensers. This oil is said to be very waxy, highly unsaturated, and high in sulfur and nitrogen.

Socony reports that mining and crushing the shale will cost $2.20 per ton, "too expensive for present commercial use." Since yields obtained varied from 17 to 40 gals per ton of shale (presumably depending chiefly upon the shale), petroleum would have to cost $3.75-$4 per barrel before the process would be commercially practicable.

These figures are at sharp variance with those reported by other sources. Estimates of mining costs presented before the O'Mahoney committee on synthetic liquid fuels (S. 1243) ranged from $0.71 to $1.22 per ton for Colorado shales. These and other figures on investments, retorting costs, and manpower requirements make an estimate for shale oil production of $2 per barrel seem far more of the correct order of magnitude. Nevertheless, the Socony experiments should prove of value to the Bureau of Mines, which is endeavoring to determine actual costs.

All of these developments are highly important. They indicate a sharp realization of the fact that petroleum reserves are not everlasting and that substitutes will eventually be required.

### Marine Gas Turbines

A very important event took place recently at Jeannette, Pa., when the Elliot Co. demonstrated the first domestic gas turbine developed as a power plant for ships. Gas turbines have been used in increasing numbers in recent years in refineries[6] and as aviation turbo-blowers, but this is the first *complete* gas turbine plant to be constructed and operated in this country.

Use of regenerative equipment in this 2,500 h.p. plant has allowed an overall efficiency of 29% to be attained, higher than the efficiency of a steam turbine of comparable horsepower and approaching that of a Diesel engine. This efficiency can probably be raised to 31% or more (32-34% on future models), and its present space of 3.5 cu. ft. per h.p. can probably be reduced to less than two cubic feet. Operating temperatures as high as 1,400° F. can be used at present.

According to Ronald B. Smith, engineering vice president of Elliot, "with secondary heat exchangers placed athwartships, the plant can be installed in a space of 16 by 12 by 12 ft, corresponding to less than a cubic foot per horsepower." At least two gas turbine plants are expected to be completed in the next nine months.

The gas turbine is thus entering the commercial field of prime movers. The petroleum industry may well look forward to providing increasing quantities of fuels for such plants, although powdered coal may eventually prove practical. In any case, the steam turbine and Diesel engine have a new competitor. All of these, of course, may someday give way to atomic power engines, but it is far too early to say when or how.

### Automobile Developments

Few industries draw such careful scrutiny from petroleum companies as does the automotive industry. The reasons in normal times are self-obvious; at present they contain the added factor of anxiety as to the speed of reconversion, based on the natural desire to have a normal or near-normal demand for automotive gasoline.

Reconversion news has come in large quantities since VE-Day, and V-J Day has but served to augment the volume. One company after another has announced its plans, and pictures of new (chiefly dressed-up, 1942) models appeared in many papers when "go-day," July 1, rolled around.

Even before VJ-Day, rumors were circulating that companies might not be held to the limits assigned by WPB (691,018 cars for the nine months ending on April 1, 1946), especially if materials and manpower were available. A counter rumor had it that the quota lid might remain on for some time to come, for fear that automobile

(5) Anon., NATIONAL PETROLEUM NEWS 37, No. 31, 38 (1945), "Oil-From-Shale Method Announced by Socony."

(6) Pew, A. E., Jr., NATIONAL PETROLEUM NEWS, *Technical Section*, 37, No. 31, R-635 (1945), "The Use of Gas Turbines in Sun Oil Refineries."

purchasing agents, always able "to talk turkey to steel salesmen," might cause other lines to be strangled through lack of steel, but post-VJ-Day developments have given this the lie.

Steel, of course, is no longer a limiting factor, but other shortages which threatened before the defeat of Japan will still require some consideration. Presses are said to be the biggest machine bottleneck, although 85% of the machine tools and other equipment for which AA-3 priorities were granted will be delivered by October 1. Plant rehabilitation is also reported to be on schedule.

Five raw materials were reported to be in short supply prior to VJ-Day: (1) tin, of which the average prewar car used six to eight pounds; (2) cadmium, used for plating; (3) antimony, a substitute for tin; (4) chromic acid; and (5) burlap.

WPB had informed the automobile producers that it would be able to remove or lift the restrictions on all products for automobile production with the exception of those on the above five products and cotton linters. The supply of tin is particularly critical, but WPB had indicated that it would provide the 50-100 tons needed as minimum requirements for solder and bearings for this year's scheduled production if the industry could develop substitutes for use next year.

Since VJ-Day, however, the situation has been further eased, although tin will continue in short supply for 12-18 months (only 67,000 tons are now on hand, compared to normal annual usage of 90,000 tons). Textiles remain a major bottleneck, also. Despite these factors, WPB now estimates that as many as 500,000 cars may yet be built this year and that production may reach a rate of 6,000,000 cars a year by July 1, 1946.

One of the most interesting recent development concerns the announcement of a new combine, the Kaiser-Frazer Corp., which will produce a light-weight, low-priced (less-than-$1,000) car on the West Coast and a medium-priced ($1,000-$1,500) car in Detroit.

The first car, the "Kaiser", may or may not be as radical as the models which are known to have been tested under the aegis of Henry J. Kaiser, while the Detroit model, the "Frazer," is expected to be of more conventional design. Joseph W. Frazer is chairman and president of Graham-Paige, which evidently will produce no model under that name. Neither car is expected to be in production until some time next year.

As expected, the "postwar jeep" is being advanced by Willys-Overland as an all-purpose vehicle. WPB has given it a ceiling price of $1,090 as a "light-truck"; i.e., stripped of the auxiliary equipment needed for use as a passenger car, farm tractor, or power-plant. This jeep has new gear ratios, capable of giving maximum efficiency at farm speeds of 3-7.5 m.p.h. Another gear ratio permits road speeds up to 60 m.p.h. at mileages up to 20 m.p.g.

The first flush of joy over the resumption of automobile production, however, should not blind the petroleum industry to the hard fact that several million cars have permanently disappeared from the highways during the war. Even though VJ-Day has permitted the resumption of unlimited automobile production, it will be at least a year before the car population approaches prewar levels and longer than that before gasoline consumption exceeds prewar peaks.

## NEW BOOKS FOR THE REFINER

### 1944-45 A.S.T.M. Standards On Copper and Copper Alloys

1944-45 *A.S.T.M. Standards on Copper and Copper Alloys*, by American Society for Testing Materials; 444 pages, heavy paper cover, $2.75

The latest edition of the *A.S.T.M. Standards on Copper and Copper Alloys* gives the specifications as of December, 1944. The some 90 standards included are widely used and cover the following groups of materials:

Wire and cable electrical conductors; non-ferrous metals (lead, nickel, tin, copper, etc.), plate, sheet, and strip; wire, rods, bars, and shapes; pipe and tubing; alloys for sand castings.

The book is made complete by the inclusion of emergency specifications and emergency alternate provisions applicable to copper and copper alloys. These have been widely used during the war.

### Theory and Application Of Infrared Spectroscopy

*Infrared Spectroscopy*, by R. Bowling Barnes, R. C. Gore, Urner Liddel and Van Zandt Williams; 6 x 9 in., 236 pages, stiff cloth binding, illustrated, $2.25.

A partial answer to the increasing demand for information concerning the industrial applications of infrared spectroscopy is presented in the recently-published book, *Infrared Spectroscopy*, by R. Bowling Barnes, R. C. Gore, Urner Liddel and Van Zandt Williams, Stamford Research Laboratories, American Cyanamid Co.

The theory of infrared absorption and its relation to molecular structure are discussed to provide the essential background for detailed descriptions of techniques useful in industrial analysis and research. Also provided is a library of 363 representative spectra of organic compounds for comparison with those obtained from unknown compounds under the same conditions.

The instrument built by the authors and described in the text is one of the first industrial instruments to be developed. The techniques and theoretical considerations discussed have been used since 1937 in the research as well as some of the control problems confronting this large chemical company. The text first was published in the November 1943 Analytical Edition of *Industrial and Engineering Chemistry*, and republished in book form by permission of the American Chemical Society, copyright owners.

Added since original publication is a bibliography containing 2700 entries and divided into author and subject indexes.

### Survey of Russian Literature On Rubber from Alcohol

*Synthetic Rubber from Alcohol*, by Anselm Talalay and Michel Magat; 6 by 9 in., 312 pages, stiff cloth cover, illustrated, $5.00.

Commercial production of synthetic rubber in this country is a relatively young accomplishment, although it has been carried out on a large scale in Russia since the early thirties. It was in Russia, in fact, that the most basic method of converting alcohol to butadiene was developed by S. V. Lebedev in the late twenties. The original Russian literature since that time has contained a wealth of detailed information on Lebedev's process and on the physico-chemical properties of butadiene-type rubber.

*Synthetic Rubber from Alcohol* is a comprehensive survey of this Russian literature, systematically arranged according to chemistry, physico-chemistry and technology, all coordinated with available literature.

Direct catalytic conversion of ethanol to butadiene is covered from both the theoretical and the practical points of view; the subsequent polymerization is discussed in theory and the engineering problems involved in this step of rubber manufacture surveyed. The properties of the rubbers produced and the Russian studies on the art of compounding such rubbers are also covered.

The authors are Anselm Talalay, with the Sponge Rubber Products Co., and Michel Magat, in the Frick Chemical Laboratories at Princeton University.

**Copies of all books reviewed on this page can be ordered from the Book Department of *National Petroleum News*, 1213 West Third St., Cleveland, 13, for the prices listed, postpaid. Ohio purchasers please add 3% sales tax.**

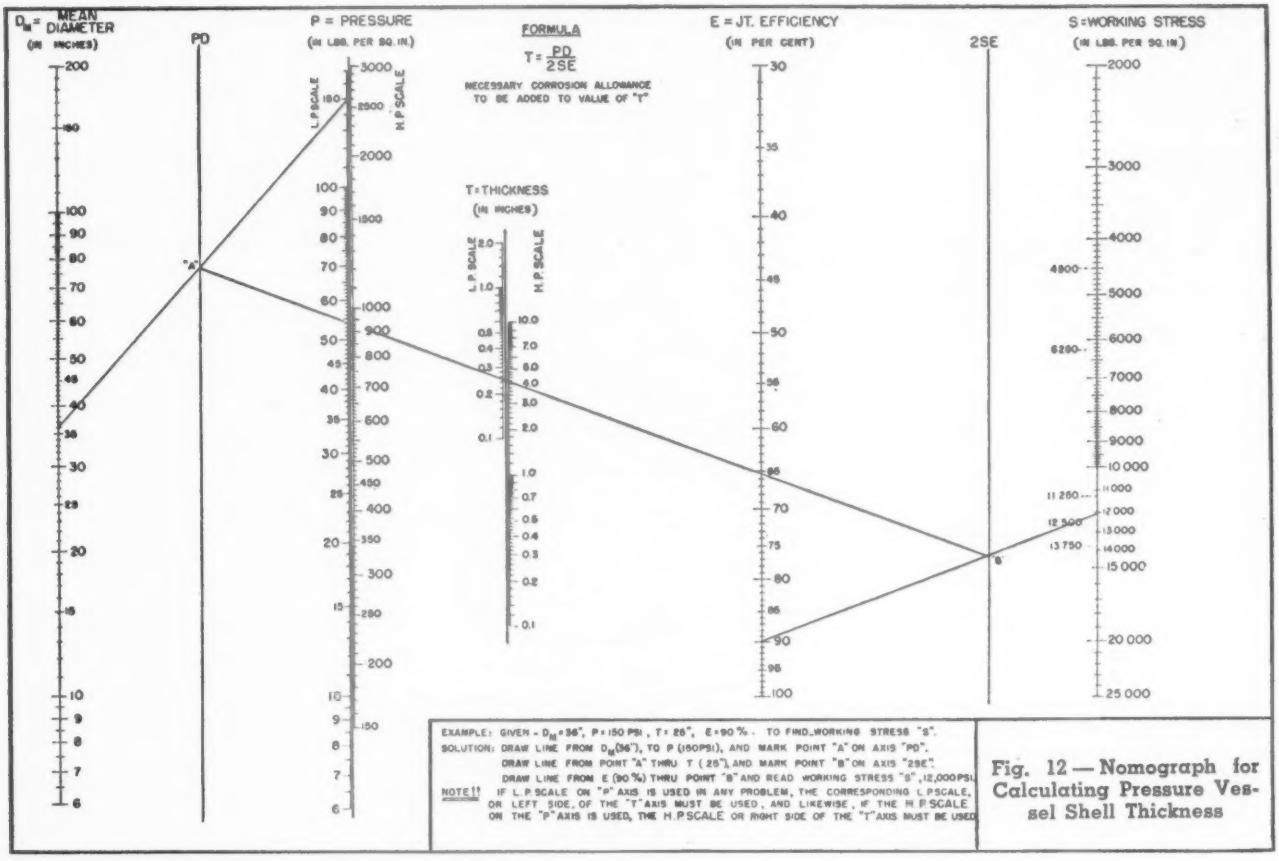

$D_M$ = MEAN DIAMETER (IN INCHES)
PD
P = PRESSURE (IN LBS. PER SQ. IN.)
L.P SCALE
H.P SCALE
FORMULA
$T = \frac{PD}{2SE}$
NECESSARY CORROSION ALLOWANCE TO BE ADDED TO VALUE OF "T"
T = THICKNESS (IN INCHES)
E = JT. EFFICIENCY (IN PER CENT)
2SE
S = WORKING STRESS (IN LBS. PER SQ. IN.)
EXAMPLE: GIVEN - $D_M$ = 36", P = 150 PSI, T = 28", E = 90 % . TO FIND WORKING STRESS "S".
SOLUTION: DRAW LINE FROM $D_M$ (36"), TO P (150PSI), AND MARK POINT "A" ON AXIS "PD".
DRAW LINE FROM POINT "A" THRU T (.28"), AND MARK POINT "B" ON AXIS "2SE".
DRAW LINE FROM E (90 %) THRU POINT "B" AND READ WORKING STRESS "S", 12,000 PSI.
NOTE!! IF L.P SCALE ON "P" AXIS IS USED IN ANY PROBLEM, THE CORRESPONDING L.P SCALE, OR LEFT SIDE, OF THE "T" AXIS MUST BE USED, AND LIKEWISE, IF THE H.P SCALE ON THE "P" AXIS IS USED, THE H.P SCALE OR RIGHT SIDE OF THE "T" AXIS MUST BE USED.

**Fig. 12 — Nomograph for Calculating Pressure Vessel Shell Thickness**

(*Continued from page R-692*)

and B-16-b.

**143.02(b) — Steel, Alloy Steel and Brass.** The limiting thickness for steel and alloy steel valves and fittings may be determined from the charts in Figs. 14, 15, 16 and 17, which are based on the modified Barlow's formula used in ASA Standard B-16-e. These charts show minimum allowable wall thickness of valves and fittings for material indicated. They are directly applicable to ASA flanged fittings and valves by nominal pipe sizes.

*Figs. 14 and 15 are on page R-750*
*Figs. 16 and 17 are on page R-752*

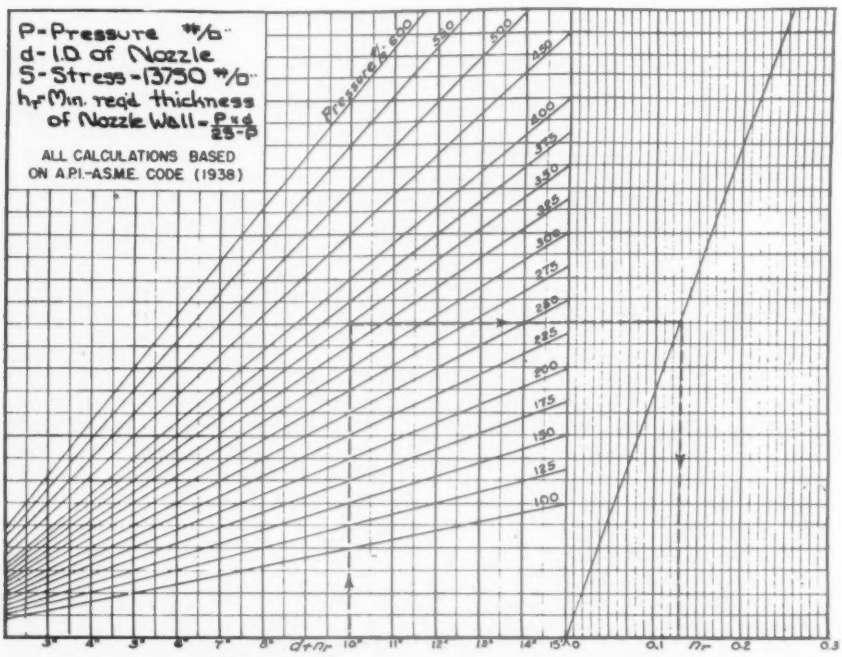

P-Pressure #/□"
d-I.D. of Nozzle
S-Stress-13750 #/□"
$h_r$ Min. reqd. thickness of Nozzle Wall - $\frac{P \times d}{2S-P}$
ALL CALCULATIONS BASED ON A.P.I.-A.S.M.E. CODE (1938)
Pressure lbs. per sq. in.
d÷nr
nr

**Fig. 13—Frequently-used limits can be profitably set up in chart form, as in the case of these minimum required thicknesses of nozzle walls**

## 144. Pipe

**144.01—General.** The ASA Code for Pressure Piping covers the basis for design of piping in various services including:

(a) Power Piping Systems
(b) Gas and Air Piping Systems
(c) Oil Piping Systems, etc.

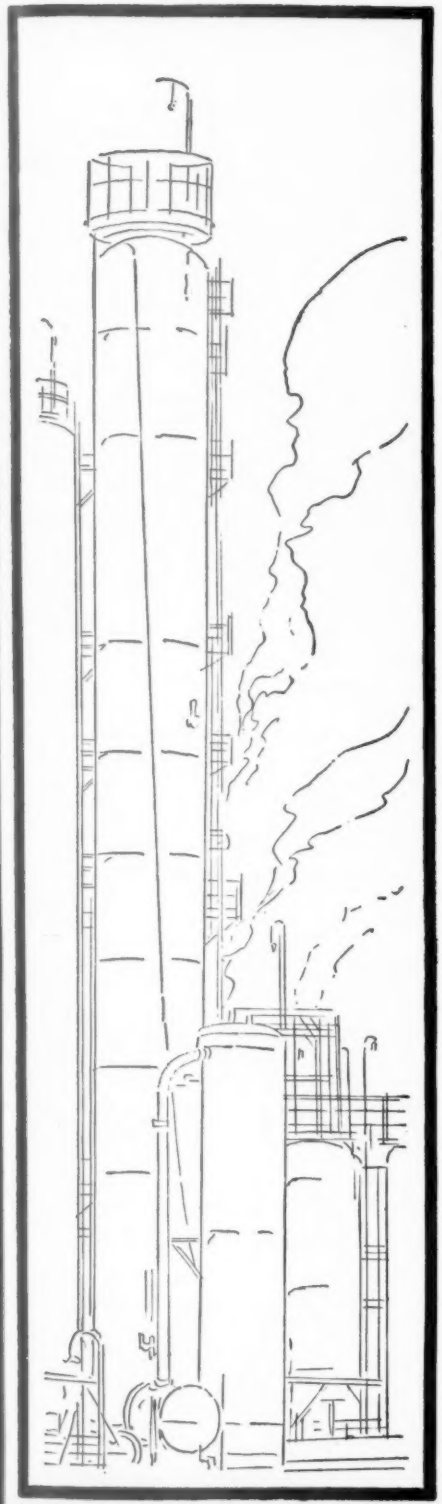
As is usual with codes of this nature, the factor of safety is high to allow for long service without failure. Taking into consideration the stresses which may be set up by line strains, etc., as well as by internal pressure, some modifications of the basic design might be used in determining retiring limits for pipe.

**144.02 — Limiting Thickness.** The minimum allowable, or retiring thickness for these items may be determined in accordance with the following formula:

$$t_m = PD/2S$$

Where $t_m$ = minimum pipe wall thickness in inches
$P$ = max. internal pressure in psi
$D$ = actual outside diameter of pipe in inches
$S$ = allowable stress, in psi

The values of S used in this formula should not exceed those given in the tables in the proper sections of the ASA piping code as referred to above. Re-



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tiring thicknesses for various grades of carbon and alloy steel can be determined from the charts in Figs. 18, 19, 20, 21, 22 and 23, which are based on

*Figs. 18 and 19 are on page R-753*
*Figs. 20 and 21 are on page R-754*
*Figs. 22 and 23 are on page R-756*

the foregoing formula. For materials not included in the charts, the allowable stress value S should be based on the best available information and the minimum allowable thickness determined by application of the above formula.

**Inspection Note:** It should be recognized that the minimum thicknesses of pipe determined in this manner are calculated for normal operating conditions. Where piping is subject to added loads due to unusual expansion and contraction, line strains, or other causes, greater thicknesses may be required than indicated by the formula or charts. In such cases, the minimum permissible thickness should be calculated, taking into account the additional loading. For operating conditions in the lower pressure-temperature range retiring thicknesses indicated by the formula or charts may be impractically small. In such cases it may be well to establish some arbitrary minimum to assure sufficient structural strength. The minimum for threaded pipe should be more than the depth of the thread.

### 145. Shell and Tube Heat Transfer Equipment

**145.01—General.** The minimum allowable thickness of shells, heads and channel elements should be determined according to the code by which they were designed, or if these are not of a specific code design, they should be calculated according to the rules given in Section 1 of the API-ASME code. This parallels the recommendation for determination of limits for pressure vessels.

In the case of horizontal stacked units or units supporting large vapor lines, the stress induced by such loading should be calculated and taken into consideration when determining the retiring limit. The minimum safe thickness for tube sheets is seldom a critical consideration as increasing leakage and inability to hold tubes tight usually occurs long before a tube sheet is thinned to the point of failure. For extreme pressure, and for single tube sheets employed with "hair-pin" or U-tubes, a minimum thickness can be determined according to the appropriate formula.

In general, it is not practical to attempt to fix minimum retirement thicknesses for tubes in heat transfer equipment. This is on account of their small size, because they fail by selective or at best irregular corrosion loss, and because of the inability to determine the thickness of the minimum tube in the bundle by measurement. For the few instances of large diameter tubes or tubes operating at very high pressures where a minimum thickness limit is required, it can be determined by the use of Barlow's formula (or Lame's for heavy wall tubes) using the conventional type formula with no additional factors and employing allowable working stress for the various tube materials as given in the ASME "Boiler Construction Code."

### 146. Fired Tubes

**146.01—General.** Fired tubes operate under a complex set of conditions which affect the limit to which they may deteriorate. In most cases the tube wall temperature increases progressively throughout the duration of a run due to accumulation of deposits on the inside. Also, variation in feed stocks or in quality of products required, necessitate different operating temperatures at various times and these result in varying tube wall temperatures.

Corrosion causes progressive thinning of the tube wall throughout its service life. A large percentage of the tubes which corrode operate at metal temperature in the creep range. All metals fail after a certain percentage of creep, the amount of creep causing failure varying between different alloys and, to a lesser extent, between different units made of the same alloy. Different temperatures cause different creep rates for the same loading. The progressive thinning of the tube wall throughout its life causes a progressive stress and therefore a progressive creep rate during this period.

Due to these variables it is impossible to accurately compute the amount of creep which has occurred at any time. Mathematical treatises have been prepared to take the progressive rate into consideration and arrive at a theoretically correct retiring thickness but so many assumptions have to be made that they have not proved practical in application.

It has been general practice to determine an approximate limit by using one of the common pressure formulas such as Barlow's or Lame's, and then to use experience on each furnace in varying these limits until an economical retiring thickness is determined. For tubes operating at metal temperatures below the creep range, common formulas, Barlow's or Lame's, are applicable without complication.

### 147. Tube Header Boxes

**147.01—Limiting Thickness.** Owing to the complex shape of tube header boxes, the magnitude of stress at various points due solely to internal pressure is practically indeterminate. In addition, stresses are set up due to expanding tubes into the headers and other stresses are caused by tightening the closures.

For these reasons, it is felt inadvisable to offer any definite retiring limits in this manual. Some operators use the same limits as they would use for fittings under the same pressure and temperature conditions. Barlow's formula plus an arbitrary constant offers one method of determining safe body thicknesses for cast header boxes. These can be computed on the strength of the cylindrical or "barrel" section of the casting. There is, however, a sufficient factor of safety in these thicknesses, to cover the more highly stressed points such as the inside of bends, flat surfaces between barrels, etc., which occur in the conventional types of return bends or header castings.

In considering multiple headers, or those with unusual or irregular section, this formula should not be used indiscriminately, but should serve as a guide only. The retiring thickness in such cases should be calculated individually, or determined on the basis of engineering judgment and operating experience.

These minimum thicknesses are not applicable to the heavier sections which are required around tube holes to withstand the expansion of tubes, and around plug holes to take the wedging action of tapered plugs. The tube hole end is seldom subject to corrosion so that minimum thickness is not essential in inspecting. For the sections surrounding plug seats the retirement thickness must be determined for individual cases.

**147.02—Other Limits.** Other limits for return bends and accessories are: the minimum safe width of the tapered seats; the minimum depth of serrations for reinstalling of tubes; the limiting thickness for plugs or caps; the limiting tolerance for wear and deformation of threads in "dogs" "lugs" or plug retaining members and their screws; the limiting stretch or maximum I.D. for serrated section of header boxes. Because of the variation in designs it is impossible to give universal rules for determining these limits. They are mentioned as limits which should be given consideration in a complete inspection program.

### 148. Pumps and Compressors

**148.01—General.** In general the necessity for establishing minimum allowable thickness for pumps and compressors is not as critical as it is for items such as vessels, fired tubes, etc. This is due to the fact that if severe thinning of the case and cover occurs the rotating element and internal surfaces are also attacked, resulting in loss of mechanical efficiency and of rigidity which shows up in excessive vibration or excessive bearing maintenance. These conditions usually govern the retirement of pump case parts. **It is recommended that the manufacturer be required to furnish original thicknesses and recommended minimum thicknesses for the service conditions involved.**

**148.02—Compressors.** In cases where minimum safe thicknesses must be established for compressor cylinders and other pressure parts because of corrosion, losses or removal of metal by reboring or other alterations, it is suggested that the manufacturer's recommendation be secured for a safe limit for the actual conditions of operation.

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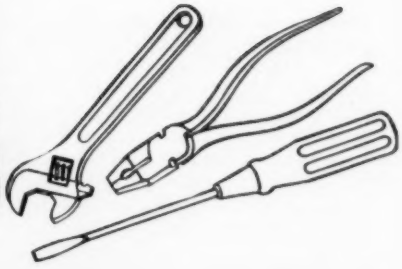

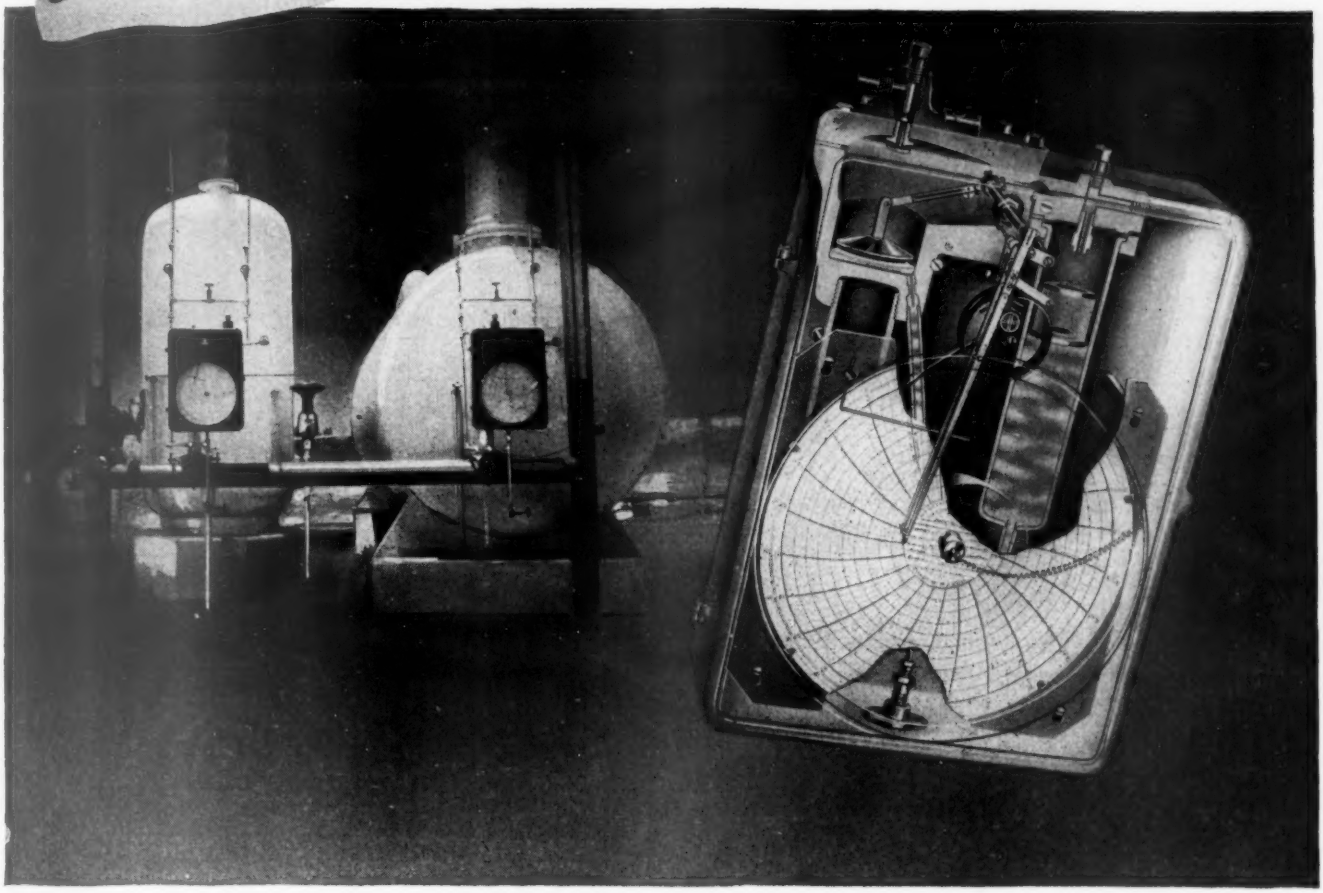

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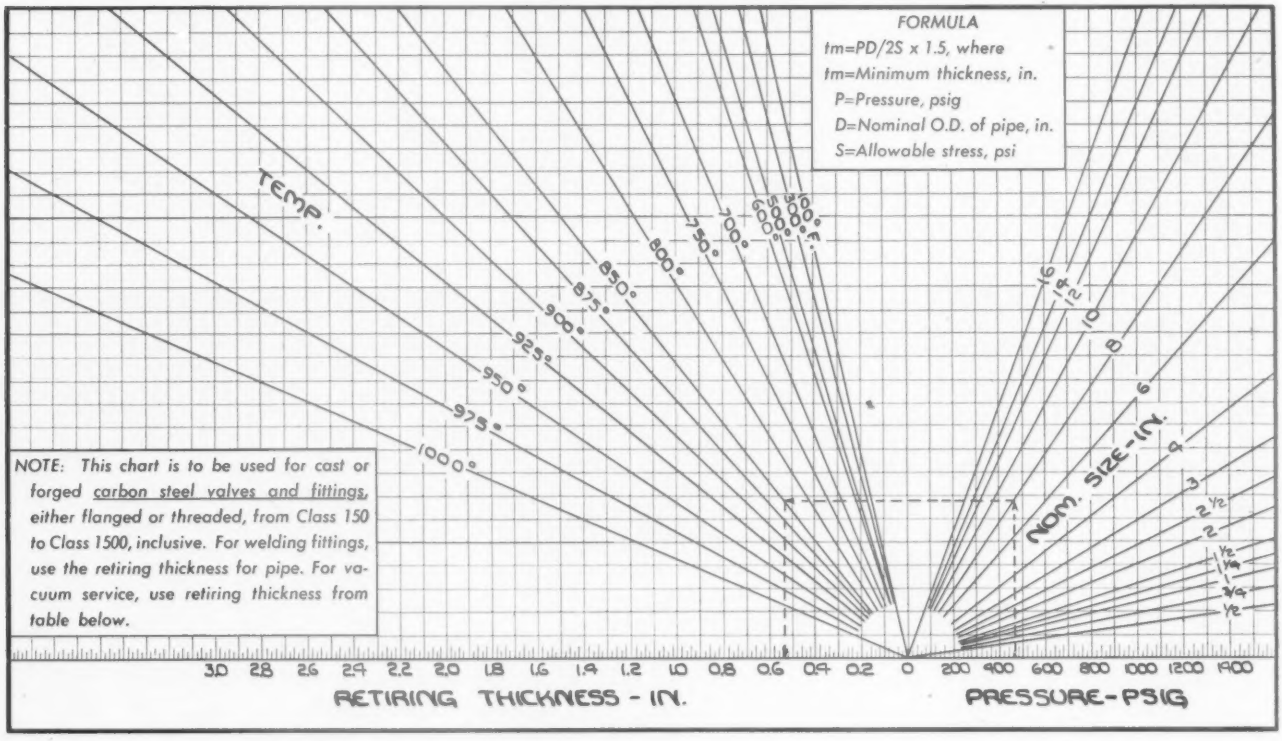
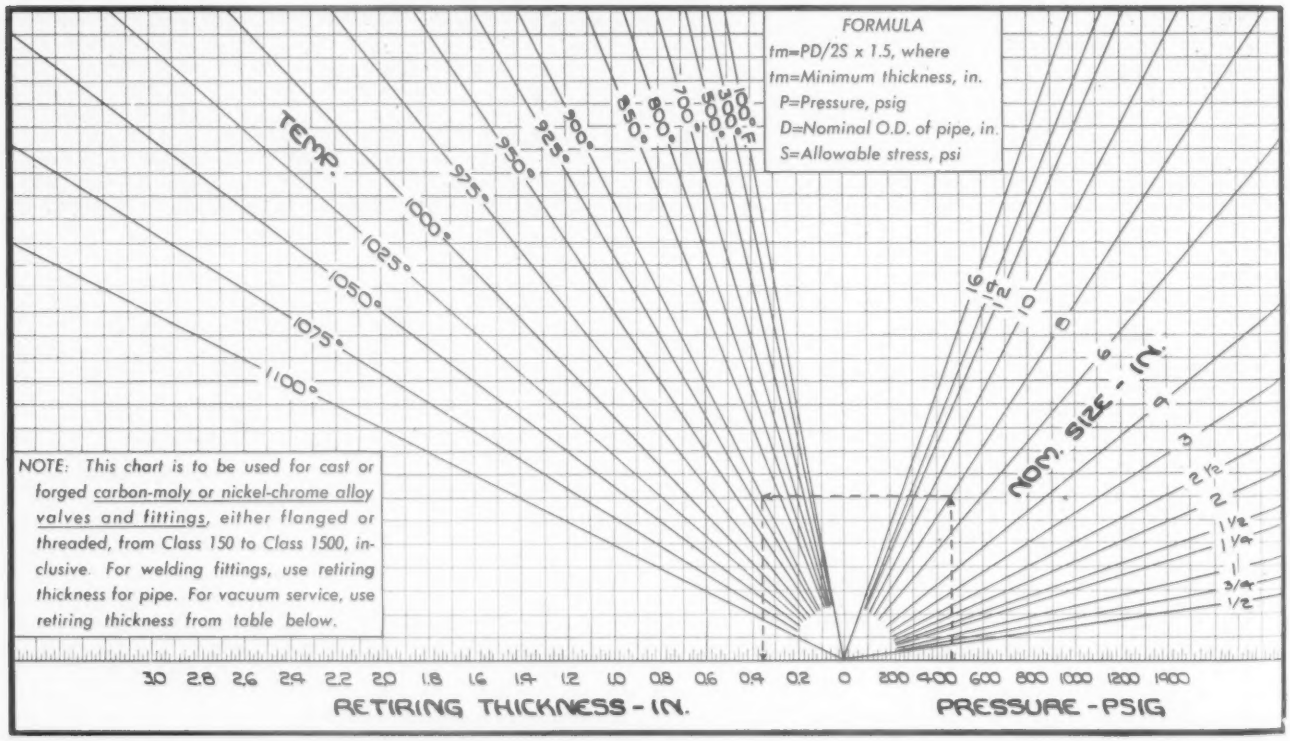

FORMULA
tm=PD/2S x 1.5, where
tm=Minimum thickness, in.
P=Pressure, psig
D=Nominal O.D. of pipe, in.
S=Allowable stress, psi
TEMP.
NOTE: This chart is to be used for cast or forged carbon steel valves and fittings, either flanged or threaded, from Class 150 to Class 1500, inclusive. For welding fittings, use the retiring thickness for pipe. For vacuum service, use retiring thickness from table below.
NOM. SIZE - IN.
RETIRING THICKNESS - IN.
PRESSURE - PSIG

*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nom. Size, Inches | 1/2 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | .094 3/32 | .094 3/32 | .094 3/32 | .125 1/8 | .125 1/8 | .125 1/8 | .156 5/32 | .156 5/32 | .187 3/16 | .219 7/32 | .250 1/4 | .250 1/4 | .250 1/4 | .250 1/4 | .250 1/4 |

FIGURE 14
Retiring Thickness
Carbon Steel
Valves and Fittings


FORMULA
tm=PD/2S x 1.5, where
tm=Minimum thickness, in.
P=Pressure, psig
D=Nominal O.D. of pipe, in.
S=Allowable stress, psi
TEMP.
NOTE: This chart is to be used for cast or forged carbon-moly or nickel-chrome alloy valves and fittings, either flanged or threaded, from Class 150 to Class 1500, inclusive. For welding fittings, use retiring thickness for pipe. For vacuum service, use retiring thickness from table below.
NOM. SIZE - IN.
RETIRING THICKNESS - IN.
PRESSURE - PSIG

*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nom. Size, Inches | 1/2 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | .094 3/32 | .094 3/32 | .094 3/32 | .125 1/8 | .125 1/8 | .125 1/8 | .156 5/32 | .156 5/32 | .187 3/16 | .219 7/32 | .250 1/4 | .250 1/4 | .250 1/4 | .250 1/4 | .250 1/4 |

FIGURE 15
Retiring Thickness
Alloy Steel
Valves and Fittings

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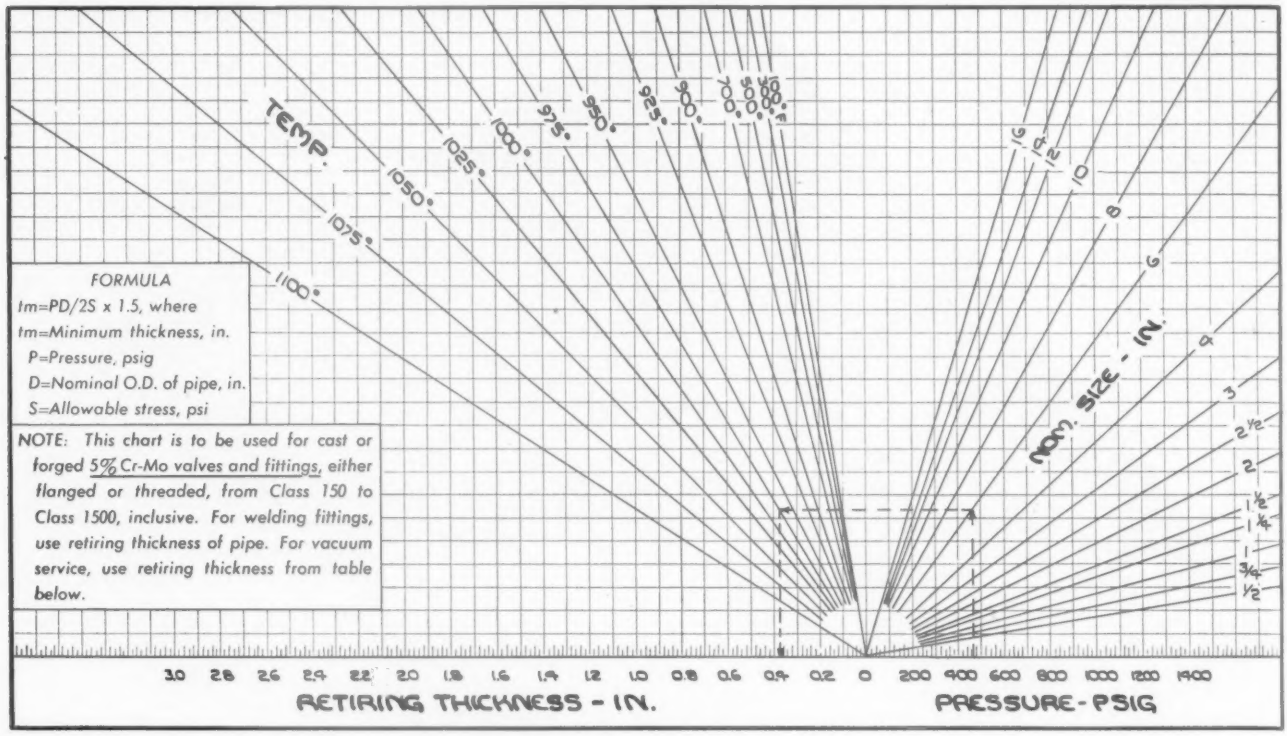
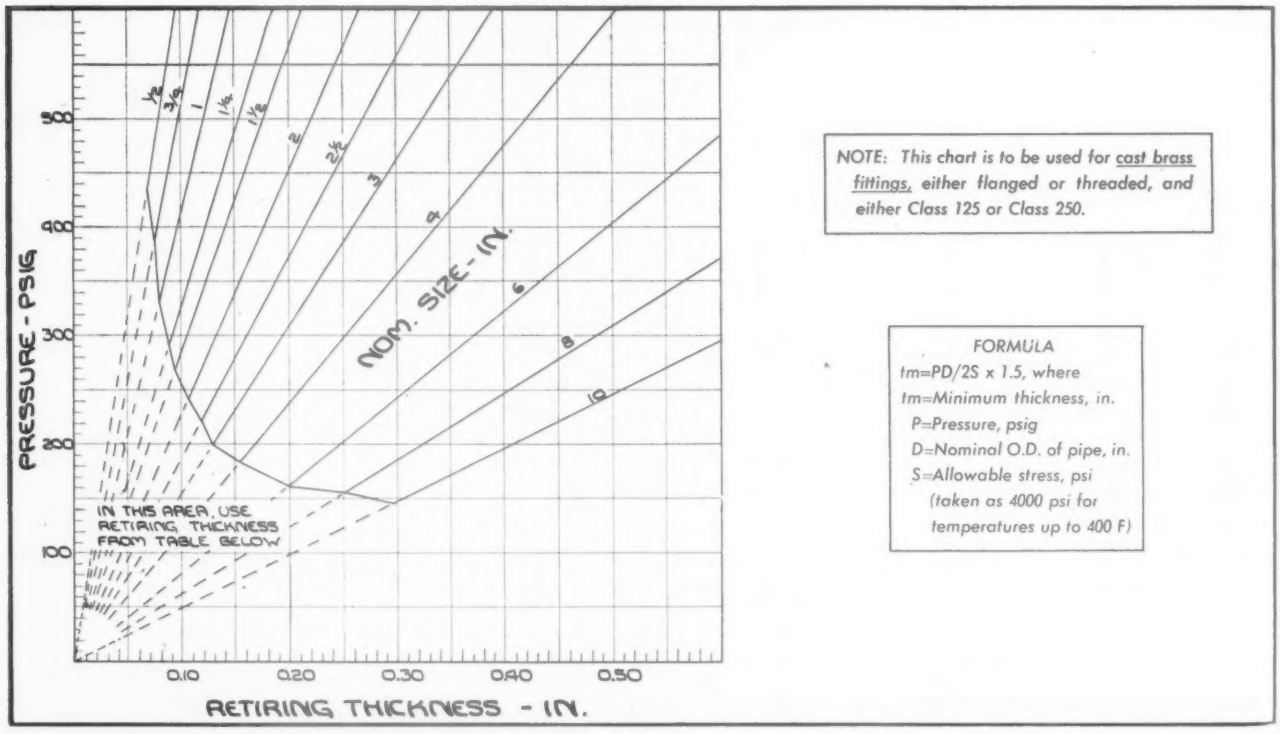



*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nom. Size, Inches | 1/2 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | .094 3/32 | .094 3/32 | .094 3/32 | .125 1/8 | .125 1/8 | .125 1/8 | .156 5/32 | .156 5/32 | .187 3/16 | .219 7/32 | .250 1/4 | .250 1/4 | .250 1/4 | .250 1/4 | .250 1/4 |

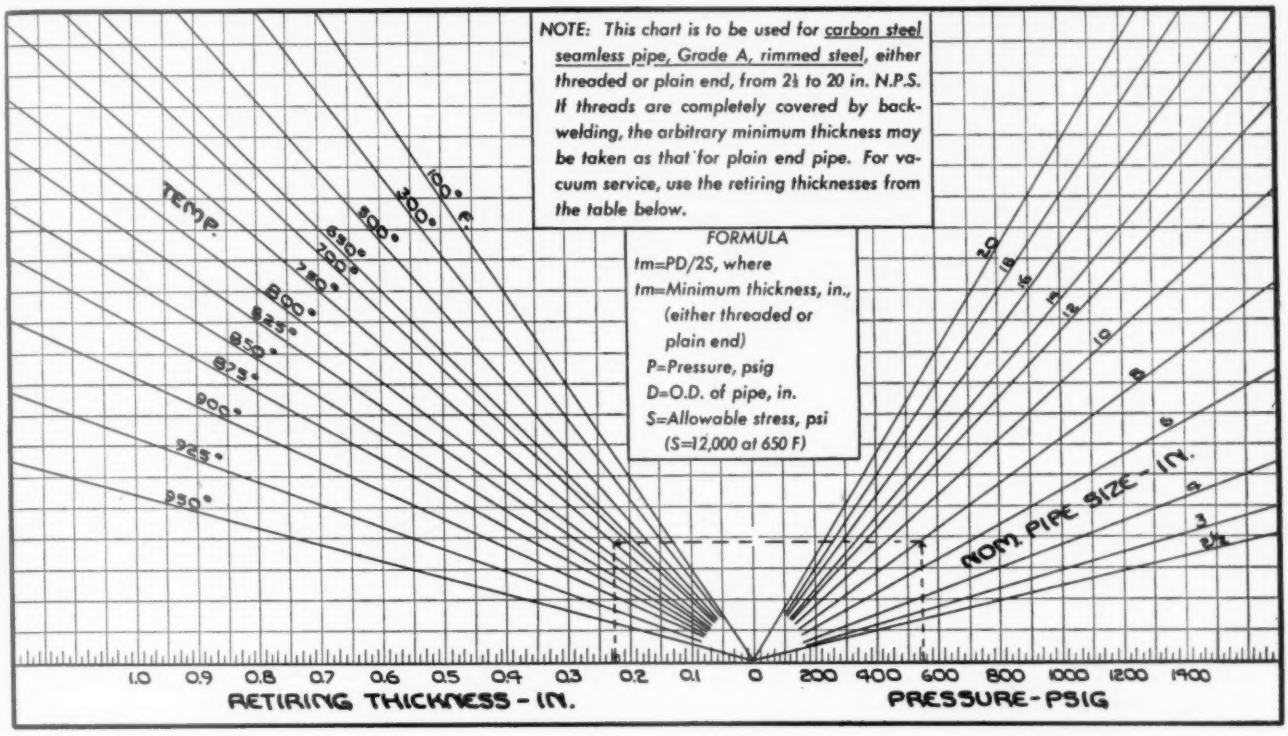
FIGURE 16
Retiring Thickness
Alloy Steel
5% Chrome-Molybdenum
Valves and Fittings




*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nom. Size, Inches | 1/8 | 1/4 | 3/8 | 1/2 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | .060 | .065 | .067 | .070 | .075 | .080 | .090 | .095 | .105 | .120 | .130 | .155 | .200 | .250 | .300 |

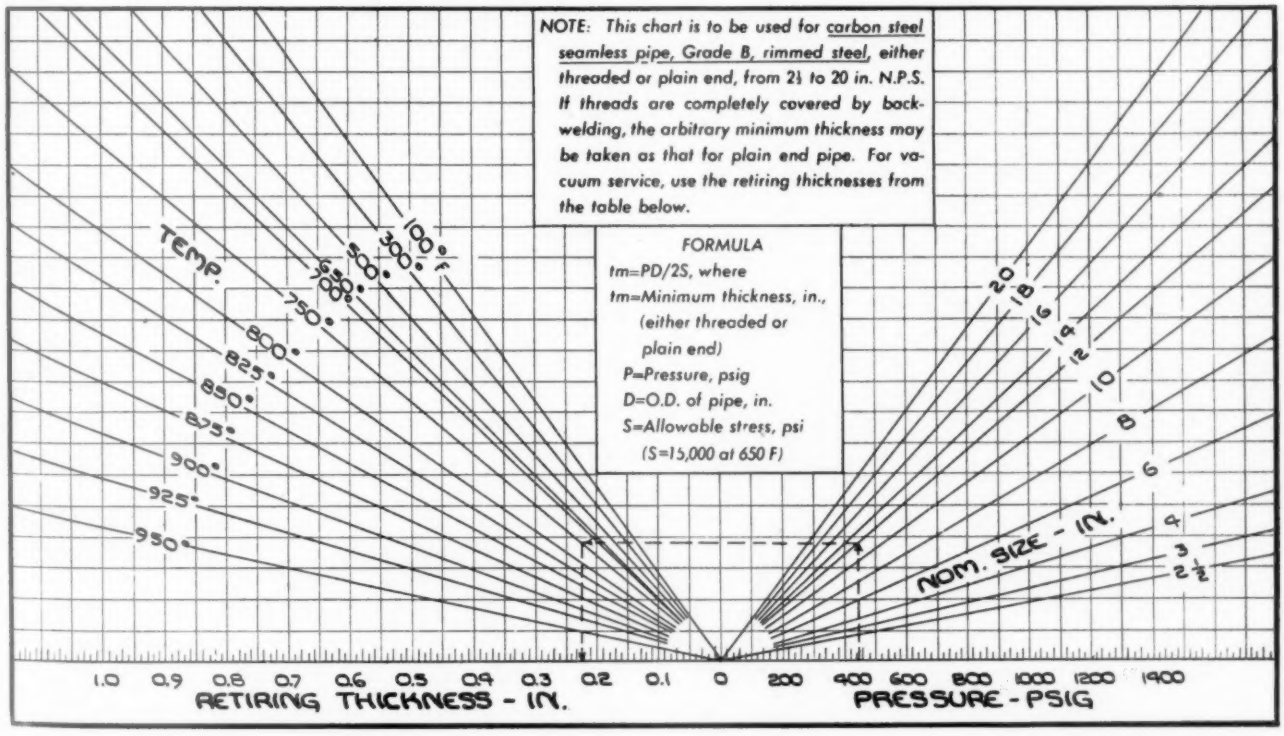
FIGURE 17
Retiring Thickness
Brass Fittings




*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nominal Pipe Size, Inches | | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | Plain End | .10 | .10 | .12 | .15 | .18 | .19 | .19 | .19 | .19 | .19 | .19 |
| | Threaded | .15 | .15 | .17 | .20 | .23 | .24 | .24 | .24 | .24 | .24 | .24 |

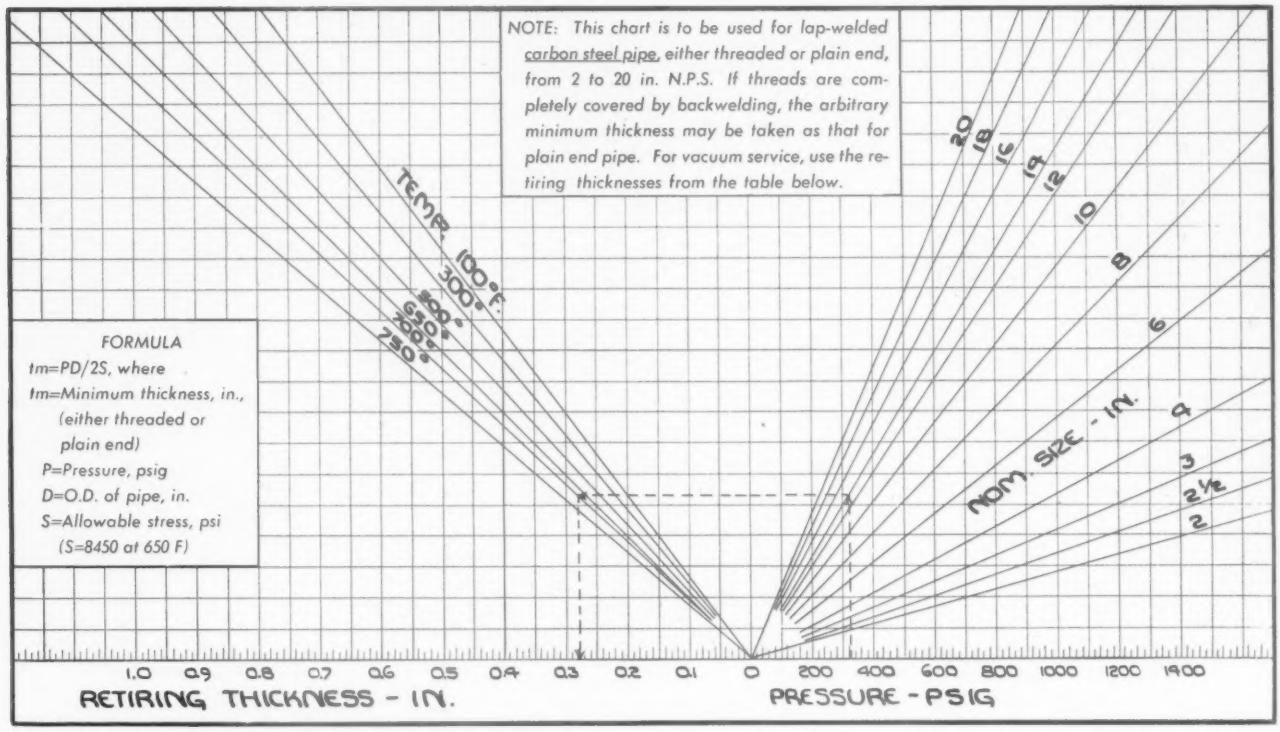
**FIGURE 18**
**Retiring Thickness**
**Seamless Steel Pipe**
**Grade A Carbon Steel, Rimmed**
**(Threaded or Plain End)**




*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nominal Pipe Size, Inches | | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | Plain End | .10 | .10 | .12 | .15 | .18 | .19 | .19 | .19 | .19 | .19 | .19 |
| | Threaded | .15 | .15 | .17 | .20 | .23 | .24 | .24 | .24 | .24 | .24 | .24 |

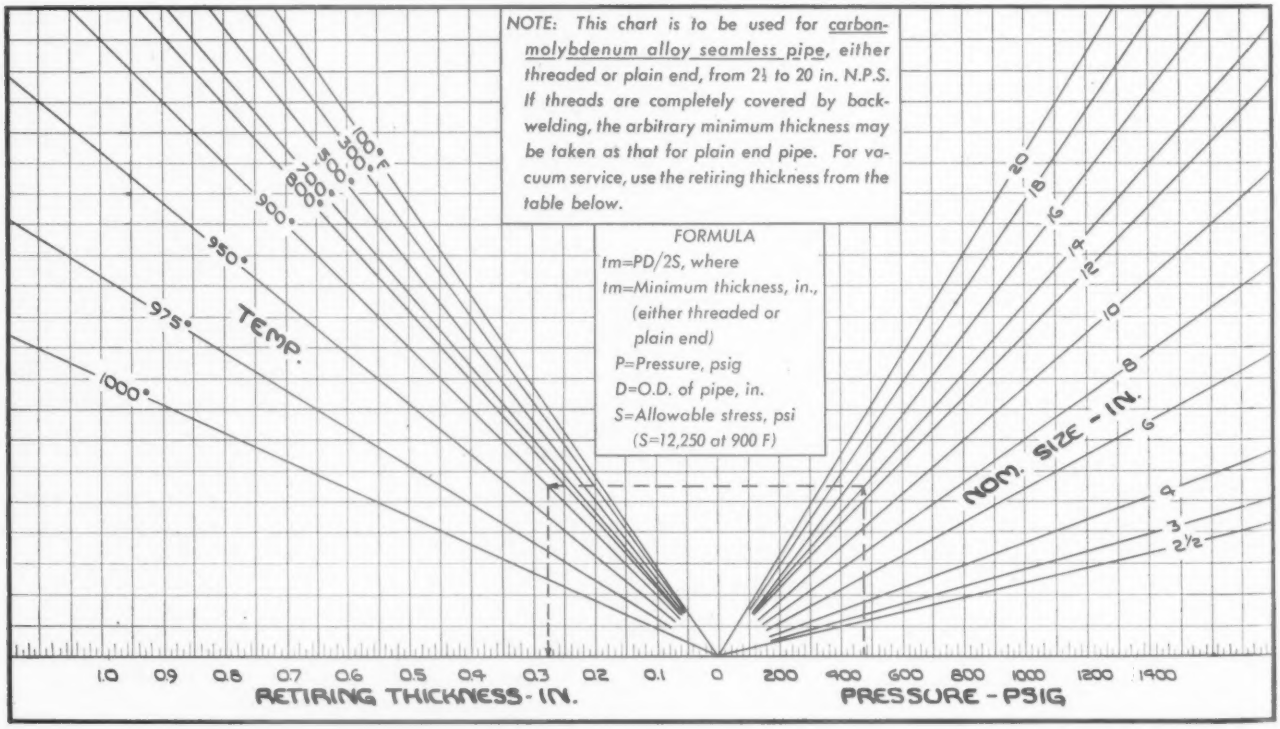
**FIGURE 19**
**Retiring Thickness**
**Seamless Steel Pipe**
**Grade B Carbon Steel, Rimmed**
**(Threaded or Plain End)**


NOTE: This chart is to be used for lap-welded carbon steel pipe, either threaded or plain end, from 2 to 20 in. N.P.S. If threads are completely covered by backwelding, the arbitrary minimum thickness may be taken as that for plain end pipe. For vacuum service, use the retiring thicknesses from the table below.
FORMULA
tm=PD/2S, where
tm=Minimum thickness, in., (either threaded or plain end)
P=Pressure, psig
D=O.D. of pipe, in.
S=Allowable stress, psi (S=8450 at 650 F)
TEMP. 100°F
300°
500°
600°
700°
750°
NOM. SIZE - IN.
20
18
16
14
12
10
8
6
4
3
2½
2
1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0
200 400 600 800 1000 1200 1400
RETIRING THICKNESS - IN.
PRESSURE - PSIG

*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nominal Pipe Size, Inches | | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | Plain End | .10 | .10 | .10 | .12 | .15 | .18 | .19 | .19 | .19 | .19 | .19 | .19 |
| | Threaded | .13 | .15 | .15 | .17 | .20 | .23 | .24 | .24 | .24 | .24 | .24 | .24 |

FIGURE 20
Retiring Thickness
Lap-Welded Steel Pipe
Carbon Steel, Rimmed
(Threaded or Plain End)




*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nominal Pipe Size, Inches | | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | Plain End | .10 | .10 | .12 | .15 | .18 | .19 | .19 | .19 | .19 | .19 | .19 |
| | Threaded | .15 | .15 | .17 | .20 | .23 | .24 | .24 | .24 | .24 | .24 | .24 |

FIGURE 21
Retiring Thickness
Seamless Alloy Pipe
Carbon-Molybdenum Steel
(Threaded or Plain End)

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Here's an insulation that won't "fall down" on the job! Unibestos will not sag, gap, shatter or shakedown under the most severe vibration—always remains snug and firm against pipe, thus assuring maximum protection with a minimum of heat loss. Moreover, Unibestos efficiency is unaffected by moisture. Even when soaked, moisture can be steamed off without damaging Unibestos structural strength.

Unibestos is available in half-section form up to 30" pipe diameter, and in quarter-section form from 32" to 60"—in thicknesses from ¾" to 5". Single layer construction is available for service up to 1200°.

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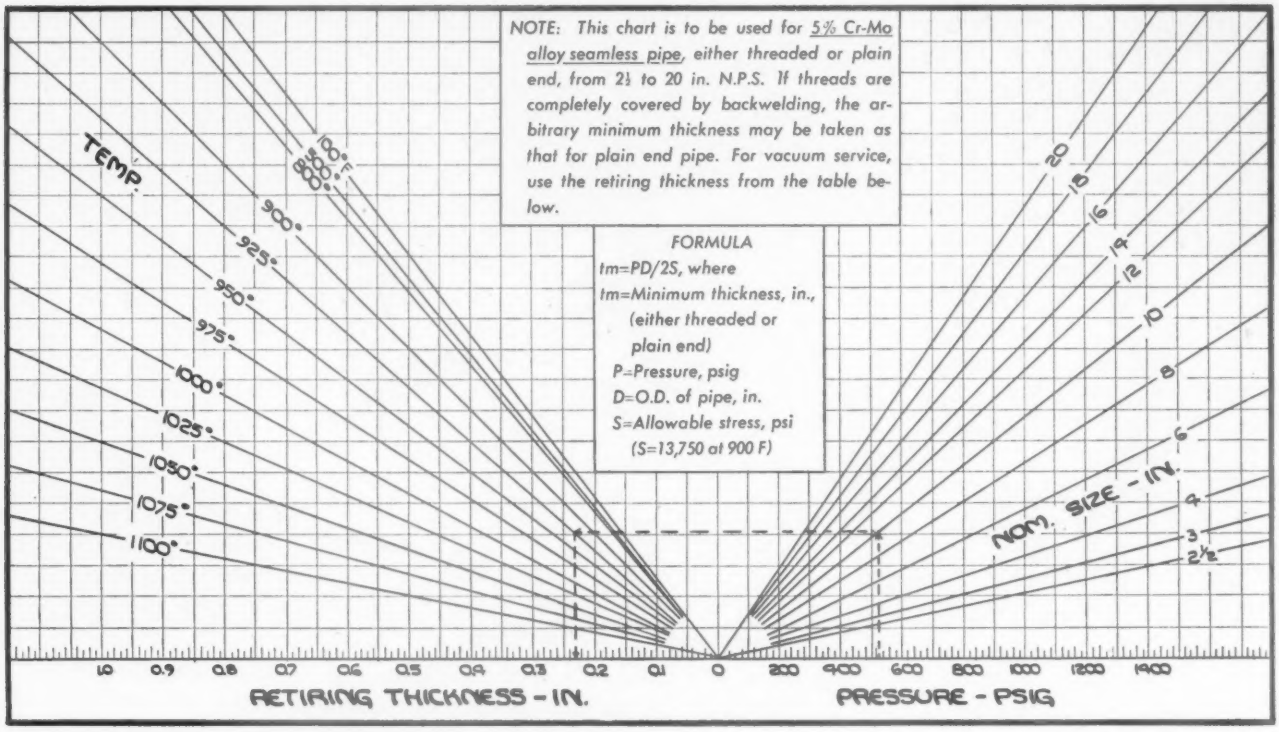
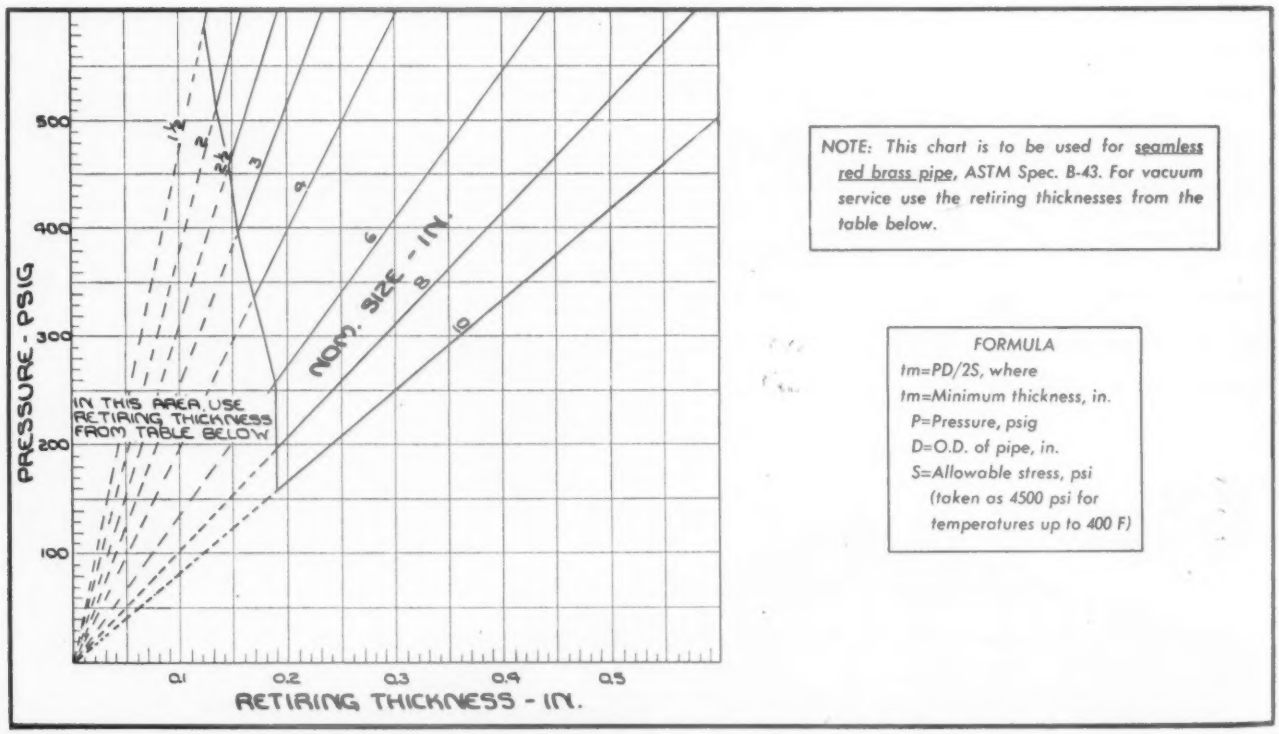



*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nominal Pipe Size, Inches | | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | Plain End | .10 | .10 | .12 | .15 | .18 | .19 | .19 | .19 | .19 | .19 | .19 |
| | Threaded | .15 | .15 | .17 | .20 | .23 | .24 | .24 | .24 | .24 | .24 | .24 |

**FIGURE 22**
**Retiring Thickness**
**Seamless Alloy Pipe**
**5% Chrome-Molybdenum**
**(Threaded or Plain End)**




*MINIMUM ALLOWABLE THICKNESS SHALL BE THAT OBTAINED FROM THE CHART ABOVE OR THE FOLLOWING TABLE, WHICHEVER IS GREATER*

| Nom. Size, Inches | 1/4 | 3/8 | 1/2 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Thickness, Inches | .06 | .07 | .08 | .09 | .11 | .12 | .125 | .135 | .147 | .153 | .167 | .188 | .188 | .188 |

**FIGURE 23**
**Retiring Thickness**
**Seamless Red Brass Pipe**
**ASTM Spec. B-43**

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## the Overall Picture of Developments in

# WARTIME REFINING TECHNOLOGY

## and Detailed Information on Four Important Phases

UNDER the stimulus of war, developments in petroleum refining technology have taken place at a startling pace . . . . new processes have been designed, engineered and catapulted into commercial use . . . . operating and maintenance techniques were vastly improved . . . . sorely needed chemicals have been built from the hydrocarbon molecules of oil . . . . these, and other developments, will make a strong impact on future refining practices.

There came a need for "rounding up" and consolidating all these inter-related developments . . . . especially for the benefit of those refinery technical men whose duties during the emergency have taken them away from their normal occupations and prevented them from keeping abreast of these changes.

The Editorial Staff of the **TECHNICAL SECTION**, National Petroleum News recognized that need and approached the problem with the idea of doing two things:

(1) Providing an accurate, concise, co-ordinated review of the wartime technological developments in *all phases* of petroleum refining . . . . this has been done in a book entitled "REFRESHER on WARTIME REFINING TECHNOLOGY".

(2) Correlating the published information, complete and authentic, on the developments in *certain phases* of refining; this has been done in four booklets, described on the next page.

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## *Refresher on* WARTIME REFINING TECHNOLOGY

This book, prepared at the suggestion of Warren C. Platt, Editor of NPN, from overseas fronts where he was an NPN war correspondent, was published primarily for refining technologists serving in the armed forces of their country . . . . to help them catch up quickly on the developments taking place in their absence. NPN is making a copy of this book available, no charge, to each such serviceman through the executive heads of refinery operating companies.

An immediate demand arose from other men who learned of the publication of the book and it is, therefore, being offered for sale to those who are not eligible, as servicemen, for free copies.

This book—REFRESHER on WARTIME REFINING TECHNOLOGY—contains concise descriptions, with flow diagrams, of the new and improved processes—catalytic cracking, manufacture of high octane blending agents, butadiene, synthetic rubber, toluene, and lubricating oils. In addition, it reviews developments in research and covers important new test methods. Included also is an Appendix, listing refineries, natural gasoline, cycling and other plants contributing to the production of aviation gasoline, synthetic rubber, toluene and lubricating oils; and a reference reading list of several hundred articles and papers.

Some of the uses that have been suggested for the REFRESHER on WARTIME REFINING TECHNOLOGY book are: textbook, as part of a training program for technical men newly entering the field of petroleum refining . . . . a "catcher-upper" for men actively engaged in refining technology but compelled, by the emergency, to limit their reading research to a very restricted part of the whole program . . . . a distinct help to operating men who desire to broaden their knowledge of technical developments . . . . a memento for those who participated in these history-making developments.

The REFRESHER on WARTIME REFINING TECHNOLOGY is a convenient, pocket-size book, 4½ x 6¾ contains over 100 pages, durable covers..... $1.25

**For convenient order blank - See bottom of next page . .**

*here's the* **OTHER HALF** *of the story* (see preceding page)

# *on* WARTIME REFINING TECHNOLOGY

## FOUR BOOKLETS Containing Reprints from wartime issues of the TECHNICAL SECTION, NATIONAL PETROLEUM NEWS

To *supplement* the review of developments in the *whole field* of petroleum refining in the REFRESHER book, described on the other side of this page, many articles—selected for their completeness and maximum contribution to a clear understanding of the subject covered—have been assembled from issues of the TECHNICAL SECTION, National Petroleum News for the past three years . . . . and are now available as reprints in a series of four booklets—*each booklet* containing a group of reprinted articles relating to *one important phase* of petroleum refining.

There is a booklet on each of the following subjects:

NEW REFINING PROCESSES..... 75 Cents
REFINERY DESIGN and CONSTRUCTION..... 75 Cents
REFINERY OPERATION and MAINTENANCE..... 75 Cents
WARTIME and POSTWAR PETROLEUM PRODUCTS..... 75 Cents

Each booklet contains 16 or more complete articles (64 to 80 pages, 8½ x 11) and covers the most important developments in its field. Thus it makes a readily usable compilation of carefully selected, chronologically arranged, authoritative articles showing the progressive developments in its particular field of refining technology.

The booklets, in combination with the REFRESHER, fill these needs:

Thorough, "brass-tacks" information for the man who has been away in war service . . . . to help him swing back into work quickly in his chosen phase of refining;

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PERSONALS

# Petroleum Technologists in the Headlines

New Chemical Products and Engineering Research departments have recently been established by Standard of Indiana.

**Bruce K. Brown,** vice president in charge of development, will have general direction of the new Chemical Products department, with **William B. Plummer** as manager. Mr. Brown was until recently the assistant deputy administrator for PAW.

Mr. Brown

Mr. Plummer prior to the war was head of the company's development and patent department, and until recently was a lieutenant colonel in the Air Technical Service Command, A. A. F.

**George W. Watts** was named director of engineering in the manufacturing department, with **D. A. Monroe** as chief designing engineer. **P. L. Krauel** was appointed chief engineer and administrative head of the company's largest engineering unit, located at the Whiting refinery, which has been enlarged to six departments with assistant chiefs as department heads.

Other personnel changes announced by Standard Indiana include the advancement of **Carl T. Kallman** to assistant general manager in charge of the operating department, replacing **William H. Tell,** on sick leave.

* * *

**C. G. Gerhold** has been appointed manager of the research and development laboratories of Universal Oil Products Co. He was previously head of the development department, and took on research when R. B. Day, who has managed the laboratories for the past seven years, left.

* * *

Formerly fuels research engineer, Standard Oil Development Co., Esso Laboratories, Elizabeth, N. J., **Gould H. Cloud** is now associated with the Humble Oil & Refining Co., Houston.

* * *

**Frank S. West** left the service of the Texas Co. Aug. 15, to become affiliated with H. S. Cole, Jr. in the partnership of West and Cole, of Houston. They will engage in gasoline and cycling plant design and consulting engineering in the field of gas, natural gasoline and condensate recovery.

Mr. West graduated in engineering from the University of California in 1923, and was with General Petroleum Corp. and Union Oil Co. of California before joining the engineering staff of the Texas Co. He has recently been chief engineer in charge of gasoline and cycling plant design and construction. Mr. Cole was also formerly with the Texas Co. as assistant to the manager of the producing department. He is also vice president of Thompson-Carr, Inc., drilling contractors, Houston.

* * *

**Robert E. Wilson,** chairman of the board and chief executive officer of the Standard Oil Co. (Ind.) has been elected a member of the Board of Trustees of the University of Chicago.

* * *

**John E. Ford,** petroleum engineer, has been appointed executive assistant to Robert B. Cragin, vice president in charge of commercial development for Houdry Process Corp. Mr. Ford is a graduate of Georgia School of Technology. His previous petroleum associations include eight years with the M. W. Kellogg Co. and service in the technical department of the Sinclair Refining Co. at Houston.

* * *

**Edward F. Wagner** has joined the Witco Chemical Co., New York, as chief chemist, and will be engaged chiefly in directing product development work. Dr. Wagner was formerly with the Standard Oil Co. of Ohio.

* * *

**Marion L. Arnold,** recently elected president of the California Natural Gasoline association, has had more than 20 years experience in the natural gasoline business and has gained a thorough knowledge of the industry's problems and ambitions.

Mr. Arnold

Mr. Arnold, who replaces C. D. Gard of the Union Oil Co. of Calif., as head of the association, was one of the original members of the organization, having joined in July 1926.

Born in Missouri, Mr. Arnold moved at an early age to western Oklahoma. He attended the University of Oklahoma and graduated in 1923 with a B. A. degree in chemistry. Soon after graduation he moved to California where, he says, he saw his first oil well. Soon after his arrival he joined the Signal Hill Gasoline Co. as a chemist.

In 1927, the Signal Hill Co. merged with the Richfield Oil Corp. Mr. Arnold continued with Richfield, and advanced through various positions including plant operator, plant foreman, gas tester, chief chemist. He now is chief engineer of the Gas department.

Mr. Arnold has been a director of the C. N. G. A. since 1940, and served as vice president during 1944. He is a member of the association's Technical and Charcoal Test committees.

* * *

**Laurance S. Reid,** formerly assistant chief engineer for the Southern Natural Gas Co., has been appointed professor of chemical engineering in the College of Engineering, University of Oklahoma. His duties will include both teaching and research. At present he is making studies in natural gas dehydration and other problems connected with the production, gathering and processing of gas-condensate mixtures at high pressures.

* * *

**Donald W. Glendinning,** formerly senior technologist at the head office of Shell Oil Co. at San Francisco, has recently been advanced to manager of distillation equipment at the company's Martinez refinery.

## ADVERTISERS' INDEX

*This index is published as a convenience to the reader. Every care is taken to make it accurate but National Petroleum News assumes no responsibility for errors or omissions.*


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# WIDENING HORIZONS

**Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing: Comment from Readers Is Invited**

## *Stimulate Industrial Research By Removing Undue Tax Burden*

ANY national program for the stimulation and coordination of scientific research must enroll the full support of industrial research if the program is to achieve its main purpose of contributing to the nation's military preparedness. Wars are fought with weapons and equipment developed before the fighting starts and the means must constantly be at hand to produce these weapons and equipment in great quantities. Such means can best be developed through industrial research, for it is the nation's industries that supply all the apparatus for waging war.

Two factors which are entirely within the control of the government greatly affect industrial research, the income tax laws and the laws governing the application of our patent system. This is pointed out in the report to the President of Dr. Vannevar Bush, director of the Office of Scientific Research and Development, the main principles of which are embodied in bills now before Congress to establish a national research program. Removal of the present uncertainties in the application of these tax and patent laws would go a long way to stimulate and increase the volume of industrial research carried on in the future.

In its discussion of the effect of the present operation of the income tax law and the regulations of the Internal Revenue Bureau on industrial research the Bush report states: "Government action in respect to this subject will affect the rate of technical progress in industry. Uncertainties as to the attitude of the Bureau of Internal Revenue regarding the deduction of research and development expenses are a deterrent to research expenditure. These uncertainties arise from lack of clarity of the tax law as to the treatment of such costs.

"The Internal Revenue Code should be amended to remove present uncertainties in regard to the deductibility of research and development expenditures as current charges against net income."

While the deduction of these items is generally permitted, states the Bush report in the section on Taxation and Research, it goes on to define the policy of the Internal Revenue Bureau as follows: "Firms that spend approximately the same amount on research and development work year after year and consistently claim these expenditures as deductions from current income seldom have substantial amounts of their claims disallowed.

"On the other hand, where the amounts spent on research and development fluctuate widely from year to year and where the taxpayer does not follow a consistent accounting practice in handling research and development expenditures, the Bureau tends to question more closely the taxpayer's treatment of such expenditures. This policy may sometimes result in less favorable treatment for new and small companies than for large established companies."

The principal uncertainty, oil companies state, has to do with the capitalization and amortization of intangible assets in research expenditures. The Treasury regulations permit intangible assets to be amortized only when the useful life of the asset can be determined with reasonable accuracy, as with patent costs, for example, which are amortized over the 17-year life of the patent. To overcome this uncertainty the Bush report recommends an option for the taxpayer with regard to the deductibility of expenditures, other than for the acquisition of tangible capital assets, along the following lines:

"(a) to deduct currently all expenditures on scientific research and the development of new products and processes, other than expenditures for the acquisition of tangible capital assets; or

"(b) to capitalize such expenditures as deferred charges and amortize them according to a specified plan that in the judgment of the taxpayer is deemed reasonable; or

"(c) to deduct currently such part of these expenditures as in the judgment of the taxpayer is deemed to be a current cost and to capitalize the remainder as deferred charges and amortize them according to a specified plan that in the judgment of the taxpayer is deemed reasonable."

Such amendments to the Internal Revenue Code would in general benefit the oil companies by allowing them to write off the costs of developing new processes and new products at a rate consistent with the pace of technological advancement in the industry. It would also provide a means for new companies to capitalize their research work on new products and recover in future years some of the money spent in developing such new products; rather than to be required to classify such costs as current expense in their first years when they perhaps have no net earnings at all. It would also provide a means for relief for established companies whose research expenditures vary considerably from year to year.

Another recommended amendment to the Internal Revenue Code in the Bush report concerns tangible capital assets used for research and would give the taxpayer the option to amortize his cost in equal amounts over five years, or to depreciate them at the same rates as ordinarily allowed on such assets. This would provide a means for the taxpayer to write off the cost of research and development equipment at a rate consistent with that at which it frequently depreciates in actual usefulness.

In addition to these proposals applying directly to the taxation of the costs of research and development work, the Bush report makes two recommendations in line with those of other groups that have studied general tax reforms, namely, that tax refunds from the carry-back provisions and from the postwar refund of 10% of excess profits taxes be made more promptly available to taxpayers and that the net operating loss carry-over provided by the present law be increased from two years to at least five or six years.

The bills already before Congress to create a new federal agency to direct a national research program do not include proposals for amending the income tax law to remove any undue taxation burdens on research carried on by industrial concerns. Such proposals would likely be in the form of separate legislation. If the matter is brought to the attention of Congress it will have to be through the efforts of technologists and company executives who have the clearest understanding of the function of industrial research in a national research policy.

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